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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FREEDOM INNOVATIONS, LLC.,
Petitioner

v.

BLATCHFORD, INC., BLATCHFORD PRODUCTS LTD., & CHAS. A. BLATCHFORD & SONS, LTD.
Patent Owner

Case No. IPR2015-000641
Patent No. 8,574,312
Title: PROSTHETIC ANKLE JOINT MECHANISM

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,574,312

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LIST OF EXHIBITS

Exhibit	Description
EX1001	U.S. Patent No. 8,574,312 to David Moser et al, titled, "Prosthetic Ankle Joint Mechanism," filed on Dec. 14, 2007, and issued on Nov. 5, 2013 ('312 patent).
EX1002	File History of U.S. Patent No. 8,574,312.
EX1003	U.S. Patent No. 8,740,991 to David Moser et al., titled "Prosthetic Ankle Joint Mechanism," filed Nov. 6, 2013, and issued June 3, 2014 ('991 patent).
EX1004	File History of U.S. Patent No. 8,740,991.
EX1005	Declaration of Professor John Michael.
EX1006	Complaint, *Blatchford Products Ltd. v. Freedom Innovations, LLC*, No. 1:14-cv-00529, ECF No. 1 (S.D. Ohio filed June 25, 2014).
EX1007	Order, *Freedom Innovations, LLC, v. Chas A. Blatchford & Sons, Ltd.*, No. 1:14-cv-01028, ECF No. 28 (D. Nev. dismissed Oct. 15, 2014).
EX1008	U.S. Patent Application Publication US2004/0044417 to Gramnas et al., titled "Device in a Leg Prosthesis," filed Aug. 22, 2001, published on Mar. 4, 2004 (*Gramnas*).
EX1009	U.S. Patent Application Publication US2005/0171618 to Christensen et al., titled "Prosthetic Foot with Energy Transfer Including Variable Orifice," filed Apr. 4, 2005, published on Aug. 4, 2005 (*Christensen*).
EX1010	U.S. Patent No. 6,443,993 to Koniuk et al., titled, "Self-Adjusting Prosthetic Ankle Apparatus," filed Mar. 23, 2001, and issued on Sept. 3, 2002 (*Koniuk*).
EX1011	U.S. Patent Application Publication US2004/0117036 to Townsend et al., titled "Prosthetic Foot with Tunable Performance," filed Mar. 29, 2002, and published on June 17, 2004 (*Townsend*).
EX1012	U.S. Patent No. 4,212,087 to Mortensen et al., titled, "Prosthetic Leg with a Hydraulic Control," filed, Nov. 16, 1978, and issued on July 15, 1980 (*Mortensen*).
EX1013	U.S. Patent Application Publication US2006/0224248 to Lang et al., titled "Prosthetic Knee Joint Mechanism," filed Mar. 12, 2004, and published on Oct. 5, 2006 (*Lang*).
EX1014	U.S. Patent No. 6,398,817 to Hellberg et al., titled, "Locking Device for a Prosthesis," filed Mar. 21, 2000, and issued on June 4, 2002 (*Hellberg*).

EX1015	DAVID ROYLANCE, ENGINEERING VISCOELASTICITY (Oct. 24, 2001).
EX1016	Eugene F. Murphy, *The Swing Phase of Walking with Above-Knee Prostheses*, BULLETIN OF PROSTHETICS RESEARCH, Spring 1964.
EX1017	BESS FURMAN, PROGRESS IN PROSTHETICS (1964).
EX1018	Edmond M. Wagner, *Contributions of the Lower-Extremity Prosthetics Program*, 1 ARTIFICIAL LIMBS 8 (1954).
EX1019	John Michael et al., *Hip Disarticulation and Transpelvic Amputation: Prosthetic Management*, in ATLAS OF LIMB PROSTHETICS: SURGICAL, PROSTHETIC, AND REHABILITATION PRINCIPLES, Ch. 21B (1992).
EX1020	U.S. Patent No. 2,470,480 to Fogg, titled "Artificial Foot," filed Apr. 23, 1946, and issued May 17, 1949 (*Fogg*).
EX1021	U.S. Patent No. 2,843,853 to Mauch, titled "Control Mechanism for an Artificial Ankle," filed Nov. 26, 1956, and issued July 22, 1958 (*Mauch*).
EX1022	T.T. Sowell, *A preliminary clinical evaluation of the Mauch hydraulic foot-ankle system,* 5 PROSTHETIC ORTHOTICS INT'L. 87 (1987).
EX1023	Felix Starker et al., *Remaking the Mauch Hydraulic Ankle*, CAPABILITIES, Winter 2010, at 1.
EX1024	U.S. Patent No. 2,541,234 to Fulton et al., titled "Hydraulic Buffer Assembly," filed Dec. 13, 1949, and issued Feb. 13, 1951 (*Fulton*).
EX1025	Certified English translation of German Patent DE818828C to Schwarz, with original and Affidavit of Certification (*Schwarz*).
EX1026	U.S. Patent No. 6,517,585 to Zahedi et al., titled "Lower Limb Prosthesis," filed Aug. 13, 1998, and issued Feb. 11, 2003 (*Zahedi*).
EX1027	U.S. Patent No. 2,851,694 to Valenti et al., titled "Artificial Leg," filed June 20, 1955, and issued Sept. 16, 1958 (*Valenti*).
EX1028	U.S. Patent Application Publication US 2006/0235544 to *Iversen* et al., titled "Device and System for Prosthetic Knees and Ankles," filed Mar. 29, 2006, and published Oct. 19, 2006 (*Iversen*).
EX1029	U.S. Patent No. 5,383,939 to James et al., titled "System for Controlling Artificial Knee Joint Action in an Above Knee Prosthesis," filed Dec. 5, 1991, and issued Jan. 24, 1995 (*James*).
EX1030	U.S. Patent 3,659,294 to Glabiszewski et al., titled "Adjustable Link for Prosthetic Limb," filed May 1, 1970, and issued May 2, 1972 (*Glabiszewski*).

I. INTRODUCTION

Petitioner Freedom Innovations, LLC ("Freedom") requests *Inter Partes* Review ("IPR") of claims 1-22 of U.S. Patent No. 8,574,312 (EX1001).

The '312 patent describes a prosthetic ankle joint mechanism that "provides a continuously hydraulically damped range of motion," such that "over at least part of the range, movement in the dorsi and plantar directions is substantially unbiased resiliently." EX1001 at 2:27-32.

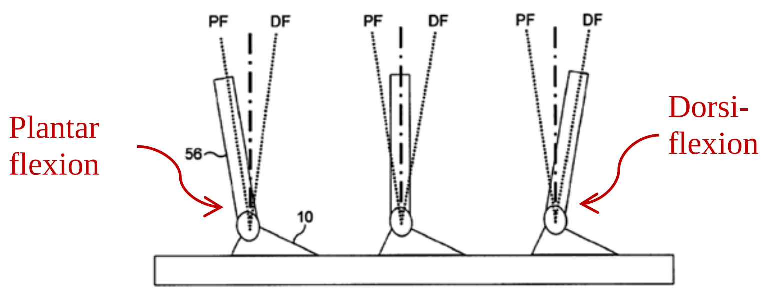


FIG. 5

The prior art, however, is replete with hydraulically damped prosthetic ankle joints, including those in which both dorsi- and plantar-flexion are predominantly provided by hydraulic damping, as required by the claims. *See, e.g.*, EX1008 (*Gramnas*); EX1010 (*Koniuk*).

Prosecution of the '312 patent lasted nearly six years and included repeated rejections based on prior art and several Examiner interviews. Eventually, the Examiner allowed claims 1-22, but only after Applicants added a limitation requiring that resistance to ankle flexion is "predominantly provided by hydraulic damping whenever the joint is flexed in both dorsi and plantar directions." EX1001 at cl. 1, 16, 20; *see also* EX1004 at 1292. As will be demonstrated in this Petition, however, that feature was already disclosed in the prior art, along with all the other limitations of the claims.

Accordingly, for the reasons explained below, Freedom respectfully requests that the Board institute IPR, review this patent, and cancel the claims.

II. GROUNDS FOR STANDING

Freedom certifies that the '312 patent is available for IPR and that the Petitioner is not barred or estopped from requesting IPR challenging the '312 patent on the grounds identified. *See* 37 C.F.R. § 42.104(a). Specifically: (1) Petitioner is not the owner of the '312 patent; (2) Petitioner is not barred or estopped from requesting IPR; and (3) Petitioner files this Petition less than a year after being served with a complaint alleging infringement of the '312 patent.

III. MANDATORY NOTICES

1. Real Party-in-Interest

Freedom Innovations, LLC is the real party-in-interest. 37 C.F.R. § 42.8(b)(1).

2. Related Matters

The '312 patent is the subject of a lawsuit filed by patent owner Blatchford on June 25, 2014, against Freedom in the U.S. District Court for the District of

Ohio. EX1006.

The ’312 patent was the subject of a later-filed declaratory judgment action by Freedom Innovations, LLC in the District of Nevada. EX1007 at 2. That action was dismissed without prejudice on October 15, 2014. *See Id.* at 11 (“Defendants’ motion to dismiss is GRANTED without prejudice.”).

Declaratory judgment actions dismissed without prejudice do not invoke the § 315(a)(1) bar against *inter partes* review. *See* 35 U.S.C. § 315(a)(1) (2014); *InVue Sec. Prods., Inc. v. Merchandising Techs., Inc.*, IPR2013-00122, Paper 17, at 9 (June 27, 2013) (“The Federal Circuit consistently has interpreted the effect of dismissals without prejudice as leaving the parties as though the action had never been brought.”) (citing *Graves v. Principi*, 294 F.3d 1350, 1356 (Fed. Cir. 2002)). Thus, the non-prejudicially dismissed Nevada action presents no bar to filing this Petition for IPR.

Freedom is concurrently filing one additional IPR petition for the ’312 patent, IPR2015-00642, and an IPR petition addressing similar claims in related U.S. Patent No. 8,740,991, IPR2015-00640.

3. Lead and Back-up Counsel; Consent to Electronic Service

The signature block of this petition designates lead counsel, backup counsel, and service information for each petitioner. Freedom designates James Barney (Reg. No. 46,539) as lead counsel. Freedom designates Jonathan R.K. Stroud

(72,518) and Daniel Chung (63,553) as back-up counsel. They can be reached at Finnegan, Henderson, Farabow, Garrett & Dunner, LLP, 901 New York Ave. NW, Washington, DC 20001. Petitioner consents to electronic service of all documents at Freedom_Ankle_IPRs@Finnegan.com.

IV. FEE PAYMENT

The required fees are submitted under 37 C.F.R. §§ 42.103(a) and 42.15(a). If any additional fees are due during this proceeding, the Office may charge such fees to Deposit Account No. 06-0916.

V. STATEMENT OF PRECISE RELIEF REQUESTED FOR EACH CLAIM CHALLENGED

1. Claims for Which Review Is Requested

Freedom requests IPR under 35 U.S.C. § 311 of claims 1-22 of the ‘312 Patent, and cancellation of these twenty-two claims as unpatentable.

2. Statutory Grounds of Challenge

Freedom requests the PTAB hold claims 1-22 unpatentable under 35 U.S.C. §§ 102 and 103 for the following reasons:

Ground	Proposed Statutory Rejections for the ’312 Patent
1	Claims 1, 3-7, and 16-22 are **anticipated** under § 102(b) by *Koniuk*.
2	Claims 2 and 8 are rendered **obvious** under § 103(a) by *Koniuk* in view of *Hellberg*.

Ground	Proposed Statutory Rejections for the ’312 Patent
3	Claims 16-22 are rendered **obvious** under § 103(a) by *Koniuk* in view of *Christensen*.
4	Claims 9-15 are rendered **obvious** under § 103(a) by *Koniuk* in view of *Mortensen*.
5	Claims 1-8 and 16-22 are **anticipated** under § 102(b) by *Townsend*
6	Claims 9-15 are rendered **obvious** under § 103(a) by *Townsend* in view of *Mortensen*.

3. Claim Construction

In an IPR, an unexpired patent’s claims receive the “broadest reasonable construction in light of the specification of the patent in which it appears.” 37 C.F.R. § 42.100(b). Unless otherwise noted, Freedom proposes that the claim terms of the ’312 patent be given their ordinary and customary meanings in the art.[1] The following three phrases, however, require construction, as dictated by the intrinsic evidence and traditional canons of claim construction. Freedom uses these

[1] No court has yet construed the claims. This claim construction analysis is not, and should not be viewed as, a concession as to the proper scope of any claim term in any litigation. Freedom does not waive the right to argue—in other litigations or proceedings—that the claims in the ‘312 patent are indefinite or otherwise unpatentable.

constructions in its grounds for unpatentability. *See id.*, § 42.104(4).

(i) *"said resistance"*

Independent claims 1, 16, and 20 use the term "said resistance." Based on traditional canons of claim construction, "said resistance" refers to the antecedent basis for the word "resistance," which appears in claim 1 as "a joint mechanism providing resistance to ankle flexion" (EX1001 at cl. 1) and in claims 16 and 20 as "a prosthetic ankle joint comprising a mechanism providing resistance to ankle flexion" (*id.* at cls. 16, 20). Accordingly, "said resistance" should be construed to mean: *resistance to ankle flexion provided by the joint mechanism*. This construction is necessary to make clear that "said resistance" is provided by the *joint mechanism* and not by some other feature outside of the joint mechanism.

(ii) *"predominantly provided by hydraulic damping"*

Independent claims 1, 16, and 20 recite that said resistance is "predominantly provided by hydraulic damping." This term should be construed to mean that *during motion of the ankle joint, resistance to movement in the dorsi and plantar direction by the joint mechanism is predominantly provided by hydraulic damping rather than resilient biasing*.

The specification supports this construction. It discloses a joint mechanism that provides a "hydraulically damped range of ankle flexion, the mechanism being constructed and arranged such that, *over at least part of the range, movement in the* *dorsi and plantar directions is substantially unbiased resiliently*." *Id.* at 2:26-33 (emphasis added); *see also id.* at 3:3-7 ("[T]he ankle allows dorsi-plantar flexion over a limited range of movement with largely damped, as opposed to resilient, resistance to motion results in an ankle which is able easily to flex under load."). The specification describes this feature as "advantageous" because the "yielding ankle" has "minimal, preferably zero elastic biasing in the dorsi- or plantar directions." *Id.* at 9:20-25. Similarly, the Abstract describes hydraulic damping "such that, *over the major part of the range of damped movement, there is no resilient biasing in either the dorsi or the plantar direction*." *Id.* at Abstract (emphasis added).

4. The Level of Ordinary Skill in the Art at the Time of the Claimed Invention

The '312 patent has an effective filing date of December 14, 2006, based on Provisional Application No. 60/869/959. A person of ordinary skill in the art at that time ("POSA") would have had at least five years of experience in prosthetics and would have been familiar with hydraulics. *See* EX1003 at ¶17.

5. State of the Art at the Time of the Claimed Invention

Doctors, engineers, and clinicians have been developing prosthetic limbs and joints for millennia. EX1016 at 1, 13, 26; EX1017 at 1. Hydraulically controlled or dampened prosthetic ankle joints have been successful since at least the 1940s. *See, e.g.*, EX1020 (*Fogg*, 1958); EX1021 at 1 (*Mauch*, 1956); EX1025 (*Schwarz*, 1949); EX1015 at 8-11 (explaining basic hydraulic damping). Fifty years ago, scholars noted "[t]he obvious and considerable virtues of fluid-controlled mechanisms for providing smooth control of the artificial knee joint over a wide range of cadences." EX1016, at 39. The commercially successful Hydraulik Ankle ("Mauch Ankle") has been available for more than fifty years. EX1021 at 1; EX1023 at 1. The Mauch, the Stewart-Vickers, EX1018 at Fig. 3 (hydraulic "ankle cylinder"), and the Schwarz ankle, EX1025 at Abstract, among others, successfully combined adjustable hydraulic dampening with ankle flexion fifty years ago. EX1019 at 544. As the '991 patent acknowledges, various means of hydraulic damping were known for prosthetic ankle joints, such as the "dual piston and cylinder assembly" of *Karas*, the "ball-and-socket joint with a chamber filled with a silicone-based hydraulic substance" of *O'Byrne*, the "adjustable hydraulic damping and resilient biasing members" of *Chen*, the "hydraulic piston and linkage arrangement" of *Gramtec*, and the "hydraulic ankle mechanism with a rotary vane" of *Iverson.* EX1003 at 1:52-2:2.

Using complex hydraulic damping resistance for ankle joints in both the dorsi- and plantar directions was also well known in 1996. For instance, *Gramnas* disclosed a prosthetic ankle joint in which the range of motion is controlled by a two-chamber valve-adjustable hydraulic piston, such that movement in both the dorsi and plantar direction is hydraulically damped and substantially unbiased resiliently. EX1008, Figs. 2a-2c. Similarly, *Koniuk* taught hydraulically damped ankle flexion provided by a two-chamber hydraulic mechanism. *See* EX1010. As early as 1964, research was discussing the basic adjustable separate-bypass passageway design. *See* EX1016 at 34 (in 1964, hydraulically damped joints designed by "providing separate bypass tubes or passages and independently adjustable valves for controlling flexion and extension" in lower-limb prostheses). Likewise, pyramid alignment interfaces have been long common in prosthetics. For instance, *Glabiszewski* (EX1030), *Hellberg* (EX1014), *Townsend* (EX1011), and *Iversen* (EX1028) taught using pyramid alignment interfaces to modularly adjust existing prostheses long ago. And *Christensen* (EX1009) and *Townsend* (EX1011), among many others, taught using leaf spring foot keels having resilient toe portions. The art recognizes foot keels are modular. *E.g.*, EX1011 at [0073] ("The prosthetic foot of the invention is a modular system preferably constructed with standardized units or dimensions for flexibility and variety in use.").

VI. SUMMARY OF THE '312 PATENT

1. Specification and Claims of the '312 Patent

The '312 patent describes an external prosthetic foot and ankle assembly. Ex. 1001 at Abstract. Pivotally mounted, it uses a hydraulic piston-and-cylinder assembly to contribute to "stabilization of standing, balance control, and improved stair-walking and ramp-walking." *Id.* The specification discloses "a prosthetic ankle joint mechanism [that] provides a continuously hydraulically damped range of ankle flexion, the mechanism being constructed and arranged such that, over at least part of the range, movement in the dorsi and plantar directions is substantially unbiased resiliently." *Id.* at 2:27-33.

Claims 1-7 recite a "prosthetic foot and ankle assembly" comprising "a foot component," "an ankle joint," and "a joint mechanism providing resistance to ankle flexion . . . ." *Id.* at 11:10-22. Claim 8 includes a "pyramid alignment interface." *Id.* at 11:60-64. Claims 9-15 refer to an assembly as in 1-7, but with a two-chamber hydraulic fluid valve arrangement capable of allowing individual setting of the dorsi- and plantar-flexion damping resistances. *Id.* at 12:8-40. Claims 16-22 refer to such an assembly as claims 1-7, having a "resilient section" allowing some "resilient dorsi-flexion of at least an anterior portion of the foot component relative to the shin access," *id.* at 12:41-54 (claim 16), such as an "energy-storing spring," *id.* at 12:65 (claim 17), part of "a Maxwell-model damper/spring combination," *id.* at 13:1-10 (claim 20), or a "leaf spring," *id.* at 13:14 (claim 22).

2. The '312 Patent Prosecution.

On December 14, 2007, Applicants requested 37 claims, claiming priority to provisional application 60/869,959, filed December 14, 2006. EX1002 at 1, 4. In September 2009, the Examiner rejected claims 1-14, 16-29, and 31-34 under 35 U.S.C. § 103(a) as being unpatentable over *Zahedi* (EX1026) in view of *Valenti*

(EX1027), and claim 15 over a tripartite combination of *Zahedi*, *Valenti*, and *Iversen* . *See* EX1002 at 574. The Examiner noted that "Iversen was used to provide evidence that pyramid adapters are well known in the art." *Id.* at 711.

Applicants amended the claims to recite a mechanism "providing resistance to ankle flexion, wherein the mechanism" has a resistance "predominantly provided by hydraulic damping." *Id.* at 596. Applicants emphasized that *Zahedi* teaches a knee joint. *Id.* at 606. Unconvinced, the Examiner issued a final Office Action in June 2010, maintaining the rejections and noting that knee and ankle joints have "similar" "stress and load requirements" and "bending characteristics" and that "it is known in the art that the joints used for knees may be adjusted in a multitude of obvious ways to function as an ankle joint." *Id.* at 619-21. Applicants filed a Notice of Appeal in November 2010. *Id.* at 655, 661.

The USPTO reopened prosecution in May 2011, and the Examiner applied new prior art rejections. *Id.* at 709. She rejected certain claims under *Zahedi*, arguing that "the apparatus *must be distinguished from the prior art in terms of structure rather than function*." *Id.* (emphasis in original). She rejected claims 7-14, 16-29, and 31-34 over *Valenti* in view of *Zahedi* (*id.* at 715), and applied *Valenti*, *Zahedi*, and *Iversen* to claim 15, again noting that "pyramid adapters are well known in the art" (*id.* at 711). She rejected claim 30 over *Valenti* in view of *Zahedi*, further in view of *Philips*, relying on *Philips* for a leaf spring "because leaf springs are a known spring that can be resilient and would function to help the ankle joint mimic the function of a normal ankle." *Id.* at 731.

Applicants responded with claim amendments reciting a "prosthetic ankle joint" and added 18 claims. *Id.* at 747-756. Applicants did not challenge or rebut the finding that both leaf springs and pyramid alignment interfaces were well known and obvious. The Examiner then issued another final rejection, withdrawing new claims 38-50 as constructively drawn to non-elected species and accepting the amendment cancelling claims 1-7. *Id.* at 976, 980. She maintained her rejection of claims 8-34 as obvious over *Valenti* in view of *Zahedi*, noting "a Maxwell-model damper-spring combination is simply a spring and damper element being arranged in series." *Id.* at 978, 980.

The Examiner further found that "[h]ydraulically dampened joints are well known in the art for mimicking the feel of a natural foot for users, and would result in a more comfortable walk for the user." *Id.* at 981. They "would result in [a leg prosthesis] having a more comfortable and natural feel while a user is walking." *Id.* at 988. She therefore found that "including the hydraulic damping joint mechanism, including the pistons, hydraulic fluids, locking mechanisms, controllers etc [sic]" would have been obvious to a POSA. *Id.* at 944. She further found it would have been obvious to use a pyramid alignment interface with a prosthetic ankle because a pyramid alignment interface "is a well-known connector in the art and will connect the foot component to the shin component strongly and securely." *Id.* at 995. Regarding leaf springs and heel spring components, she again found that "leaf springs are a known spring that can be resilient and would function to help the ankle joint mimic the function of a normal ankle." *Id.* at 996.

Applicants filed an RCE cancelling claims 38-50, further amending claims 8, 17, 23, 24, 28, 31, and 32, and challenging the prior-art rejections. *Id.* at 1216. Soon thereafter, Applicants initiated an examiner interview. *Id.* at 1230. The Interview Summary states that the Examiner agreed that "if the 'continuous hydraulic dampening' requires a velocity-dependent dampening mechanism . . . then Valenti would no longer be used as a main reference," and that "a new search would have to be made." *Id.*

In June 2013, Applicants submitted a Preliminary Amendment with a Request for Prioritized Examination, which the USPTO granted, issuing another non-final rejection in July 2013. *Id.* at 1257-1258. In it, the Examiner rejected many of the claims as anticipated by US2004/0054423 to Martin (*id.* at 1260) or obvious over *Martin* in view of *James* (EX1029). *See* EX1002 at 1266. And she rejected dependent claims under § 103 in view of *Martin*, *James*, and *Townsend*. For claim 30, she applied *Martin* in view of *Phillips*, again for disclosing a leaf spring.

In August 2013, Applicants initiated another interview with the Examiner. In the August 14, 2013 Interview Summary, the Examiner indicated that only § 102 rejections were discussed and that Applicants proposed amending the claims to include that

> "the ankle joint is mounted to the foot component, the ankle joint comprising: a mechanism providing resistance to ankle flexion, wherein the mechanism is constructed and arranged such that said resistance is predominately provided by hydraulic damping whenever the ankle joint is flexed in both dorsi and plantar directions."

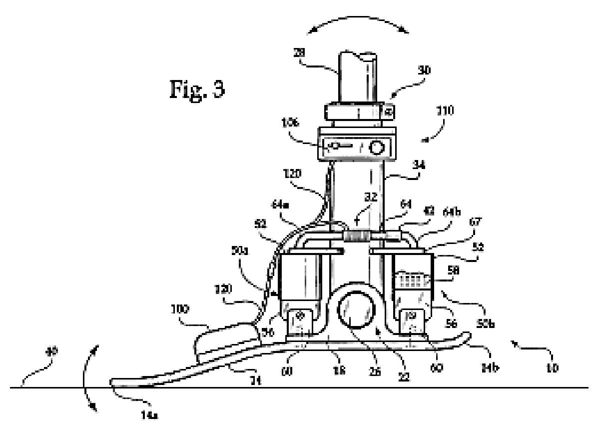
Id. at 1292. Per the Summary, the "Examiner agreed that this language would overcome the prior art of Martin, but noted that a further search would have to be made." *Id.*

On August 17, 2013, Applicants filed a proposed amendment, adding new claims and including their own summary of the interview of August 7, 2013. *Id.* at 1302. The Examiner issued another final rejection based on the previous restriction requirement but otherwise indicated, without explanation, that the remaining claims were allowable. *Id.* at 1315. Shortly thereafter, the Examiner allowed the non-withdrawn claims, providing no Reasons for Allowance. *Id.* at 1321-1332.

VII. CLAIMS 1-22 OF THE ’312 PATENT ARE UNPATENTABLE

1. Ground 1: Claims 1, 3-7, and 16-22 Are Anticipated Under 35 U.S.C. § 102(b) by *Koniuk*

Koniuk (EX1010) was published on September 3, 2002, and is prior art to the ’312 patent under § 102(b). During prosecution, *Koniuk* was cited via IDS, listed as an anticipatory reference by the International Search Report, and was indicated “pertinent,” but was not relied on. EX1002 at 548, 576, 578, 954. *Koniuk* describes an “auto-adjusting prosthetic ankle” and foot apparatus. *See* EX1010 at Abstract. Figure 3 of *Koniuk* (reproduced below) illustrates the prosthetic ankle and foot apparatus 10, which includes a foot blade 14 connected to a base portion 18. *See also id.* at 6:4-10 (“the prosthetic ankle apparatus 10 may include a lower base portion 18 . . . structured for accepting and having a foot blade 14 fixed thereto”).



“An attachment portion [34] structured for fixing to a lower portion of a prosthetic limb/leg” (*id.* at 4:37-39) is pivotally mounted to the base portion 18 that is fixed to the foot blade 14. *See id.* at 6:9-14. *Koniuk* explains that "a lower leg portion of a prosthetic limb," such as a "common prosthetic pylon," is fixed to the apparatus 10. *Id.* at 6:10-16. From this disclosure, one of ordinary skill in the art would have understood the lower leg portion of the prosthetic limb to be a shin component including an axis. EX1003 at ¶34. *Koniuk* further discloses that the attachment portion 34 includes a clamp 30 to "accept and securely couple" the lower leg portion of the prosthetic limb to the foot blade. EX1010 at 6:13-16.

Koniuk describes that a "damping means is included . . . , which is preferably directly and functionally coupled between the base portion 18 and the attachment portion 34." *Id.* at 6:23-28; *see also id.* at 7:66-8:3. This damping means "enable[s] a damping level to be established that affects the pivoting of the ankle apparatus 10," *id.* at 6:23-26, and specifically, it "enables a level of damping applied to a relative motion between the base portion 18 and the attachment portion 34," *id.* at 6:29-31.

Koniuk explains that the "damping applied resist[s] motion between the base portion and the attachment portion." *Id.* at 4:43-45. To that end, *Koniuk* discloses that the damping means "include[s] a hydraulic system including one or more hydraulic cylinders," *id.* at 6:34-36, to "lightly damp or heavily damp a relative motion between the base portion and the attachment portion as a user is walking," *id.* at Abstract. "[E]ach hydraulic cylinder 50 is structured having a cylinder casing

52 and an associated piston 56. . . . One or more sealing rings (compression rings) may [be] included for containing the hydraulic fluids within the hydraulic cylinders." *Id.* at 8:23-28. *Koniuk* also teaches that each piston 56 is coupled to the base portion 18 via "a mounting and support bumper 60." *Id.* at 8:29–31.

Koniuk discloses that the resistance to movement in the dorsi and plantar direction provided by the ankle joint mechanism is predominantly by hydraulic damping rather than by resilient biasing. In one exemplary embodiment, the hydraulic system includes a first hydraulic cylinder 50a that resists pivoting motion of the attachment portion 34 in a counterclockwise direction towards a front portion 14a of the foot blade 14 (i.e., dorsi-flexion) and a second hydraulic cylinder 50b that resists pivoting motion of the attachment portion 34 in a clockwise direction towards a heel portion 14b of the foot blade 14 (i.e., plantar-flexion). *See id.* at 6:46-57.

The damping means in *Koniuk* provides hydraulic resistance to dorsi- and plantar-flexion by controlling the rate of fluid flow through a fluid transfer conduit 64 that fluidly couples the first and second hydraulic cylinders 50a, 50b. *See id.* at 6:38-46. Notably, this damping mechanism does not include any resilient biasing of the attachment portion 34 in either the counterclockwise or clockwise direction during movement of the attachment portion 34.[2] *See* EX1003 at ¶46.

Koniuk teaches that the damping means controls the level of damping by "altering the resistance to fluid flow through [the] fluid transfer conduit," EX1010 at 6:58-60, and recognizes that the level of damping may be "established at one of a first damping level or a second damping level, or possibly any level therebetween," *id.* at 6:28-33. Thus, resistance to flexion of the attachment portion 34 is adjustable. *Id.* at 7:36-39 ("It may be noted that the user interface 106 may optionally be included, as required, to enable a user or wearer to make calibrating or operational adjustments to the circuits and modules of the auto-adjusting ankle apparatus 10."); 6:65-7:3 ("Further, it is certainly possible to employ convention damping control arrangement, including piezo-type values [sic, valves], controllable pet-cock arrangements, and other flow control mechanisms available and known to skilled persons."); *see also* EX1003 at ¶49.

[2] Although foot blade 14 provides resilient resistance to dorsi-flexion, that blade is not part of the ankle joint mechanism, just as in the '312 patent. EX1001 at Fig. 1. Thus, when looking only at the resistance provided by the ankle joint mechanism, as required by the '312 patent claims, it is clear that all such resistance is provided by hydraulic damping, not by resilient resistance.

Koniuk further discloses that the damping means limits the pivoting or flexing of the attachment portion 34 to a predetermined range relative to the front portion 14a and the heel portion 14b of the foot blade 14. *See* EX1010 at 2:30-37 ("The attachment portion is pivotally fixed to the base portion, thereby enabling a pivoting or pivoting motion between the base portion, and items such as a foot blade that may be fixed thereto, with respect to the attachment portion. For example, a pivoting motion may include a range of plus/minus 10 to 30 degrees, and may enable a pivoting to any selected position between a first position and a second position.").

As shown in Fig. 3, the pistons 56 move within the hydraulic cylinder casings 52 of the hydraulic cylinders 50a, 50b. *See id.* at 8:21-23. *Id.* at 4:13-15; Fig. 1. The cylinder casings 52 each include a mechanical end that represents the maximum displacement possible, where the piston 56 mechanically abuts the top end of, and thus fills, one hydraulic cylinder, either 50a and 50b. *See id.*, Fig. 3; EX1003 at ¶¶30-31. Thus, for instance, as the attachment portion 34 approaches the maximum limit of dorsi-flexion (e.g., 10^{o} counterclockwise rotation), piston 56 is forced upward into cylinder 50a until it engages the top end of the cylinder chamber. *See* EX1010 at 2:30-37; Fig. 3; EX1003 at ¶¶43-44. In this manner, the top ends of the cylinder casings 52 abut with pistons 56 to provide mechanical end-stops to the range of motion at the top ends of the cylinder casings 52, thus defining a limited range of movement for the pistons 56 within the cylinders 50a, 50b—which in turn provide a limited range of flexion for the attachment portion 34. *See* EX1010, Fig. 3; EX1005 at ¶¶43-44.

Koniuk also discloses that when the attachment portion 34 is pivoted to the limit in the direction of the front portion 14a of the foot blade 14b, the position of the prosthetic limb clamp 30 on the attachment portion 34 relative to the foot blade 14 is independent of the orientation of the prosthetic apparatus 10. *See* EX1010 at Abstract ("[t]he damping mechanism . . . damp[s] a relative motion between the base portion and the attachment portion as a user is walking to provide an auto-adjusting of the prosthetic ankle to changes in a ground surface being traversed and during various stages of a walking cycle"); *see also id.* at 3:1-7; 5:36-45; EX1005 at ¶¶34-40.

Moreover, based on *Koniuk*'s explicit teaching of a "foot blade 14" and the '312 patent's recognition that resilient foot components were conventional and well known, one of ordinary skill in the art would have understood at least the front portion 14a of *Koniuk*'s foot blade 14 to be a resilient, spring section. *See* EX1001 at 9:64-67 ("[t]he yielding action is provided by a hydraulic damper coupled to conventional foot elements (i.e. keel, carrier and independent carbon fibre composite heel-toe springs)."); *see also* EX1005 at ¶36. The resilient spring section of at least the front portion 14a of the foot blade 14 flexes toward the attachment portion 34 and the axis of the prosthetic limb as a load is applied onto the front portion 14a. *See* EX1010, Fig. 3; 7:59-65 (A "damping level is achieved by suitably energizing the coil 32 to stiffen the ankle once the pylon 28 is vertical[] to allow the weight of the wearer to be supported upon the foot blade 14. In addition, the coil is substantially de-energized (or substantially less energized) to allow the foot to flex once it is lifted and then again contacts the ground surface."); *see also* EX1005 at ¶37. Moreover, the resilient, spring section of the front portion 14a acts in series with the damping means, such that the front potion 14a flexes and a "damping level is achieved . . . to allow the weight of the wearer to be supported upon the foot blade 14." EX1010 at 7:59-62; EX1005 at ¶37.

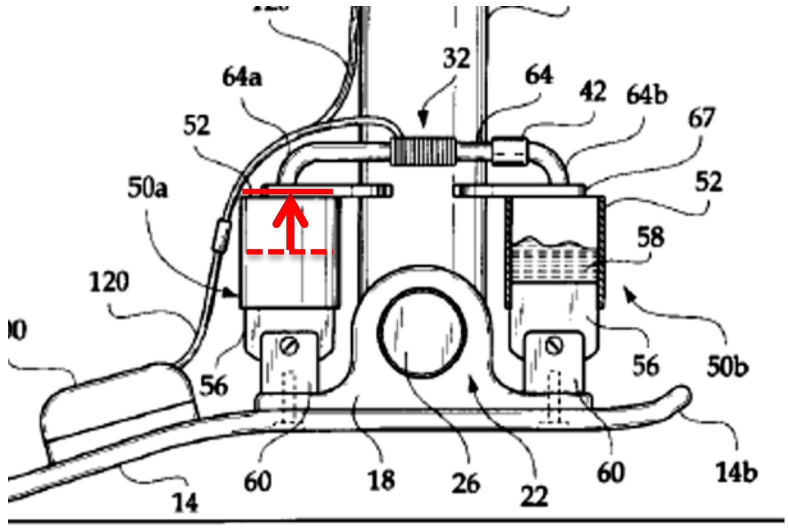
As explained in the charts below, *Koniuk* discloses each limitation of claims 1, 3–7, and 16–22 of the '312 patent, anticipating these claims under § 102(b).

Independent Claim 1	**Citations in *Koniuk***
[1.0] A prosthetic foot and ankle assembly comprising the combination of:	*Koniuk* (EX1010), Fig. 3; Abstract ("An auto-adjusting *prosthetic ankle apparatus* includes . . . a *foot blade*.") (emphasis added).
[1.1] a foot component; and	EX1010 at 6:4-10 ("[T]he prosthetic ankle apparatus 10 may include a lower base portion 18 . . . structured for accepting and having a *foot blade* 14 fixed thereto.") (emphasis added).
[1.2] an ankle joint mounted to the foot component, the ankle joint comprising:	EX1010 at 3:35-41 ("The terms 'ankle' or 'ankle joint' . . . may . . . include[e] a base portion structured for accepting and being fixed to a foot blade, an attachment portion structured for fixing to a lower portion of a prosthetic limb/leg, and a . . . pivot arrangement enabling a pivoting motion between the base portion and the attachment portion.").

	Id. at 6:4-16 ("[T]he prosthetic *ankle apparatus 10* may include a lower base portion 18 that is coupled via an ankle pivot pin 26 to an attachment portion 34. The portions of the apparatus forming the pivot location of the apparatus may be termed a 'main ankle pivot'. . . . The attachment portion 34 is structured for fixing the prosthetic ankle apparatus 10 to a lower leg portion of a prosthetic limb. . . . [A]n attachment portion 34, which is pivotally fixed to the base portion 18, may be arranged with a pylon clamp 30 to accept and securely couple to a common prosthetic pylon 28.") (emphasis added).
[1.3] a joint mechanism providing resistance to ankle flexion,	EX1010 at 4:41-48 ("The terms 'dynamically controlled damping level' and 'damping level' are to be understood to indicate that, in real-time, a level of *damping applied resisting motion between the base portion and the attachment portion* can be changed, most preferably in a rapid, step-wise manner.") (emphasis added). *Id.* at 6:23-33 ("A dynamically controllable damping means is included that is structured to enable a damping level to be established that affects the pivoting of the ankle apparatus 10, which is preferably directly and functionally coupled between the base portion 18 and the attachment portion 34. The dynamically controlled damping means 48, as shown in FIGS. 3 and 4, selectively enables a level of *damping applied to a relative motion between the base portion 18 and the attachment portion 34 to be established at one of a first* damping level or a second damping level, or possibly any level therebetween.") (emphasis added). *Id.* at 7:66-8:3 ("[E]ach of the first hydraulic cylinder 50a and the second hydraulic cylinder 50b includes a hydraulic cylinder casing 52. Each hydraulic cylinder casing 52 is structurally coupled to the attachment portion 34.").
[1.4] wherein the joint mechanism is constructed and arranged such that during walking said resistance is	EX1010 at Abstract ("The damping mechanism enables a damping level to be selectively applied to lightly damp or heavily damp a relative motion between the base portion and the attachment portion as a user is walking."). *Id.* at 6:34-60 ("[T]he dynamically controllable damping

predominantly provided by hydraulic damping whenever the ankle joint is flexed in both dorsi- and plantar-flexion directions.	means 48 will include a hydraulic system including one or more hydraulic cylinders providing a plurality of hydraulically coupled internal pressure cylinders. A most preferred form of damping is realized by a dynamically controlled damping of a pivoting motion of the ankle that simply controls a rate of flow of fluid that is transferred from a first internal pressure chamber 58 to a second internal pressure chamber. . . . As such, *when the attachment portion 34 is pivoted in a counter clockwise direction, fluid is transferred from a first hydraulic cylinder 50a*, which is positioned in front of the attachment portion 34 and closer to a front portion of an attachable foot blade 14. The fluid transferred from the first hydraulic cylinder 50a is coupled to a second hydraulic cylinder 50b that is positioned behind the attachment portion 34, closer to a heel portion of an attachable foot blade 14. *Similarly, fluid is transferred in the opposite direction, from the second hydraulic cylinder 50b to the first hydraulic cylinder 50a as the attachment portion 34 is pivoted in a clockwise direction*. It must be noted that such a structure enables a damping level to be established by simply altering the resistance to fluid flow through a fluid transfer conduit 64.") (emphases added); s*ee also* EX1005 at ¶25-33.

Dependent Claim 3	
[3.1] A prosthetic foot and ankle assembly according to claim 1, further comprising a shin connection interface,	EX1010 at 6:13-16 ("[A]s illustrated in FIG. 3, an *attachment portion 34*, which is pivotally fixed to the base portion 18, may be arranged with a pylon clamp 30 to accept and securely couple to a *common prosthetic pylon 28*.") (emphases added); *see also* EX1005 at ¶34-35; 42.
[3.2] wherein the joint mechanism includes a flexion limiter limiting dorsi-flexion of the joint mechanism to a dorsi-flexion limit, and wherein the assembly is arranged such that the dorsi-flexion limit	The top end of cylindrical casing 52 associated with cylinder 50a constitutes a "dorsi-flexion limiter" because piston 56 contacts the top end of cylindrical casing 52 when it reaches the limit of dorsi-flexion:

corresponds to a predetermined relative orientation of the shin component interface relative to the foot component.	 *See id.*, Fig. 3; EX1005 at ¶43-46. EX1010 at 2:30-37 ("The attachment portion is pivotally fixed to the base portion, thereby enabling a pivoting or pivoting motion between the base portion, and items such as a foot blade that may be fixed thereto, with respect to the attachment portion. *For example, a pivoting motion may include a range of plus/minus 10 to 30 degrees*, and may enable a pivoting to any selected position between a first position and a second position.") (emphasis added).

Dependent Claim 4	
[4.1] A prosthetic foot and ankle assembly according to claim 3, wherein the dorsi-flexion limit is defined by a mechanical end-stop operative by the abutment of one part of the assembly associated with the shin component interface against another part of the assembly associated with the foot	The top end of cylindrical casing 52 of cylinder 50a constitutes a "mechanical end-stop operative by the abutment" of piston 56 (associated with the foot component) against the top end of cylindrical casing 52 (associated with the shin component interface). *See* Limitation [3.2] above. EX1010 at 8:1-4 ("Each hydraulic cylinder . . . is structurally coupled to the attachment portion 34. For example, a mounting plate may be employed."). *Id.* at 8:21-28 (The "hydraulic cylinder 50 is structured having a cylinder casing 52 and an associated piston 56.

component.	As shown, each hydraulic cylinder 50 forms and contains an internal pressure chamber 58 which results from a piston 56 being located within the casing, thereby establishing the internal chamber therein. One or more sealing rings (compression rings) may include the use of a mounting for containing the hydraulic fluids within the hydraulic cylinders 50.”). *Id.* at Fig. 3; *see also* EX1005 at ¶43-46.

Dependent Claim 5	
[5.1] A prosthetic foot and ankle assembly according to claim 4, wherein the joint mechanism comprises a hydraulic linear piston and cylinder assembly, wherein the piston has a distal connection and the cylinder has a proximal connection, and wherein the end stop is defined by the piston and an end wall of the cylinder.	The top end of cylindrical casing 52 of cylinder 50a constitutes an end-stop “defined by the piston and an end wall of the cylinder.” *See* Limitation [4.1] above; EX1010 at Fig. 3. The joint mechanism in *Koniuk* comprises a hydraulic linear piston and cylinder assembly (*see id.* at Fig. 3, items 50a, 50b, 56, and 64), where piston 56 has a distal connection to foot blade 14 via support bumper 60 and cylinders 50a and 50b have a proximal connection to mounting plate 67. EX1010 at 8:21-23 (The “hydraulic cylinder 50 is structured having a cylinder casing 52 and an associated piston 56.”); 8:29–31 (“coupling a lower portion of the piston 56 to to the base portion 18 may include the use of “a mounting and support bumper 60”); EX1005 at ¶43-47.

Dependent Claim 6	
[6.1] A prosthetic foot and ankle assembly according to claim 1, further comprising a shin connection interface,	*See* Limitation [3.1] above.
[6.2] wherein said joint mechanism includes a flexion limiter limiting dorsi-flexion of the joint mechanism to a dorsi-flexion limit, and	*See* Limitation [3.2] above.

[6.3] wherein the assembly is arranged such that the relative position of the foot component and the shin connection interface at the dorsi-flexion limit is defined independently of the orientation of the assembly in space.	EX1010 at Abstract ("The damping mechanism . . . damp[s] a relative motion between the base portion and the attachment portion as a user is walking to provide an auto-adjusting of the prosthetic ankle to changes in a ground surface being traversed and during various stages of a walking cycle."). *Id.* at 3:1-7 ("[T]he advantage of selectively and dynamically alternating between a first and second damping level may result in a much more natural gait and walking motion, along with the ability to automatically adjust the prosthetic ankle of the invention to . . . the slope of a ground surface being traversed."); 5:36-45 ("[W]aiting for the lower leg portion 16c to be plumb, rather than simply orthogonal to the foot[,] allows the wearer to adapt to an incline, wherein the foot must flex past the orthogonal position, to a position where the foot actually forms an acute angle with the lower leg portion 16c."); *see also* EX1005 at ¶43-48.

Dependent Claim 7	
[7.1] A prosthetic foot and ankle assembly according to claim 1, arranged such that the resistance to flexion of said joint mechanism in a direction of dorsi-flexion is adjustable.	EX1010 at 6:28-33 (The "damping means . . . *selectively* enables a level of damping . . . to be established at one of a first damping level or a second damping level, or possibly any level therebetween.") (emphasis added). *Id.* at 6:54-60 ("[F]luid is transferred in the opposite direction, from the second hydraulic cylinder 50b to the first hydraulic cylinder 50a as the attachment portion 34 is pivoted in a clockwise direction. It must be noted that such a structure enables a damping level to be established by simply *altering the resistance to fluid flow through a fluid transfer conduit 64*.") (emphasis added). *Id.* at 7:36-39 ("It may be noted that the user interface 106 may optionally be included, as required, to *enable a user or wearer to make calibrating or operational adjustments* to the circuits and modules of the auto-adjusting ankle apparatus 10.") (emphasis added); *see also* EX1005 at ¶43-49.

Independent Claim 16	
[16.0] A lower limb prosthesis comprising:	*See* Limitation [1.0] above.
[16.1] a shin component defining a shin axis,	*See* Limitation [3.1] above.
[16.2]. a foot component, and	*See* Limitation [1.1] above.
[16.3]. a prosthetic ankle joint comprising a mechanism providing resistance to ankle flexion,	*See* Limitations [1.2]-[1.3] above.
[16.4]. wherein the mechanism is constructed and arranged such that said resistance is predominantly provided by hydraulic damping whenever the ankle joint is flexed in both dorsi- and plantar flexion directions,	*See* Limitation [1.4] above.
[16.5] said ankle joint coupling the shin component to the foot component,	*See* Limitation [3.1] above.
[16.6] wherein at least one of the foot component and the shin component includes a resilient section allowing resilient dorsi-flexion of at least an anterior portion of the foot component relative to the shin axis.	*See* EX1010, Fig. 3 (foot blade 14 and front portion 14a); 7:59-65 (A "damping level is achieved by suitably energizing the coil 32 to stiffen the ankle once the pylon 28 is vertical[] to allow the weight of the wearer to be supported upon the foot blade 14. In addition, the coil is substantially de-energized (or substantially less energized) to allow the foot to flex once it is lifted and then again contacts the ground surface.") EX1001 at 9:64-67 ("The yielding action is provided by a hydraulic damper coupled to conventional foot elements (i.e. keel, carrier and independent carbon fibre composite heel-toe springs)." *See also* EX1005 at ¶31, 36.

Dependent Claim 17	
[17.1] A prosthesis according to claim 16, wherein the foot component comprises an energy-storing spring arranged to be deflected when a dorsi-flexion load is applied to the foot anterior portion.	*See* Limitation [16.6], *supra'* EX1005 at ¶37.

Dependent Claim 18	
[18.1] A prosthesis according to claim 16, wherein the resilient section is associated with the coupling of the foot component and the ankle joint.	EX1010, Fig. 3 (showing resilient front portion 14a of the foot blade 14 associated with the coupling point between the foot blade 14 and the attachment portion 34); EX1005 at ¶38.

Dependent Claim 19	
[19.1] A prosthesis according to claim 16, wherein the resilient section is associated with the coupling of the shin component to the ankle joint.	EX1010, Fig. 3 (showing resilient front portion 14a of the foot blade 14 associated with the coupling point between the attachment portion 34 and the prosthetic limb); EX1005 at ¶38.

Independent Claim 20	
[20.0] A prosthetic foot/ankle assembly comprising the combination of	*See* Limitation [1.0] above.
[20.1] (a) a prosthetic ankle joint comprising a mechanism providing resistance to ankle flexion,	*See* Limitations [1.2]-[1.3] above.
[20.2] wherein the mechanism is constructed and arranged such that said resistance is predominantly provided by hydraulic damping whenever the ankle joint is flexed in both dorsi- and plantar-flexion directions, and	*See* Limitation [1.4] above.
[20.3] (b) a prosthetic foot having an anterior portion, a posterior portion and an ankle-mounting portion,	*See* Limitations [1.1] and [1.4] above; *see also* EX1010, Fig. 3 (front portion 14a, heel portion 14b, and base portion 18).
[20.4] wherein the assembly constitutes a	*See* Limitations [1.4] and [16.6]

Maxwell-model damper/spring combination comprising a damper element and a spring element, wherein the damper element is said ankle joint and the spring element is a spring component arranged in series with the ankle joint.	above; EX1010 at 7:59–62 (A "damping level is achieved . . . to allow the weight of the wearer to be supported upon the foot blade 14."); *see also* EX1005 at ¶39.

Dependent Claim 21	
[21.1] An assembly according to claim 20, wherein the spring component is located distally of said ankle joint.	*See* Limitation [16.6] above.

Dependent Claim 22	
[22.1] An assembly according to claim 20, wherein the spring component is a leaf spring supporting the anterior portion of the foot on the ankle-mounting portion thereof.	*See* Limitation [16.6] above.

2. Ground 2: Claims 2 and 8 Are Rendered Obvious Under 35 U.S.C. § 103(a) by *Koniuk* in View of *Hellberg*

To the extent *Koniuk* does not explicitly disclose certain features recited in claims 2 and 8, *Hellberg* (EX1014) supplies these teachings. *Hellberg* was published on June 4, 2002, and is prior art to the '312 patent under § 102(b). *Hellberg* was not cited in prosecution. EX1002.

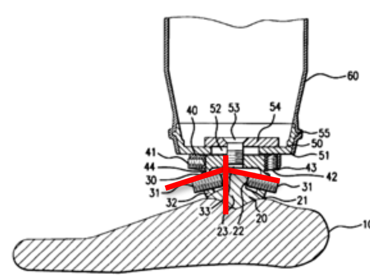


FIG.2

Hellberg relates to "an adjustment device for an artificial arm or leg." EX1014 at 1:9–10. *Hellberg* recognizes the importance of the prosthesis "be[ing] adjusted in both the angular and translatory direction, so that the user does not apply load in an unnatural way to the prosthesis." *Id.* at 1:19–22. *Hellberg* teaches that the adjustment device includes an "angular adjustment means . . . comprised of . . . a pyramid adapter . . . which is attached . . . to a . . . prosthesis member." *Id.* at

2:57-63. In one embodiment (Fig. 2, reproduced above), *Hellberg* discloses an artificial foot 10 and a pyramid adapter 20 coupling the artificial foot 10 with a lower leg prosthesis sleeve 60 having an axis. *See also id.* at 3:48–54, 4:44–47. Based on these teachings, a POSA would understand that *Hellberg*'s pyramid adapter 20 adjusts the tilt of the lower leg prosthesis sleeve 60 to any appropriate angle, including at least 3° relative to the vertical towards the front of the artificial foot 10, for a user to properly apply load to the prosthesis. EX1005 at ¶¶155-158.

i. ***Rationale* to Combine *Koniuk* and *Hellberg***

It would have been routine for a POSA to modify the *Koniuk* apparatus 10 such that its prosthetic limb clamp 30 includes a pyramid adapter 20 to attach to a lower leg prosthesis sleeve 60 and adjust the angular orientation of the lower leg prosthesis relative to the foot blade 14, including at an angle of least 3° relative to the vertical towards the front portion 14a, as disclosed by *Hellberg*. EX1014 at 1:19–22; EX1003 at ¶159. There would have been nothing unpredictable or unexpected in developing the claimed pyramid alignment interface allowing adjustment of the shin component axis in the anterior and posterior directions relative to the foot component because the ’312 patent itself recognizes that such pyramid interfaces were conventional and well known to the POSA. *See* EX1001 at 2:66–3:2 (“[a]djustment of the shin axis orientation in the anterior-posterior direction with respect to the foot component may be performed using at least one *conventional pyramid alignment interface*, preferably the shin component interface"); *id.* at 6:53–59 ("Typically, a tubular shin component is mounted to the shin connection interface 20, the shin component having, at its distal end, an annular female pyramid receptacle having alignment screws, as *well known to those skilled in the art*, for adjusting the orientation of the shin component relative to the ankle unit 16.") (emphases added); EX1003 at ¶160. The Examiner likewise concluded that "pyramid adapters are well known in the art." EX1002 at 711.

Thus, the combination of *Koniuk* and *Hellberg* teaches the elements of claims 2 and 8, rendering these claims unpatentable under § 103(a).

3. Ground 3: Claims 16-22 Are Rendered Obvious Under 35 U.S.C. § 103(a) by *Koniuk* in View of *Christensen*

To the extent the Board concludes that *Koniuk* does not explicitly disclose a resilient section, as recited in claims 16-19, or a spring element, as recited in claims 20-22, *Christensen* (EX1009) supplies these teachings. *Christensen* was published on August 4, 2005, and is prior art to the '312 patent under § 102(b). *Christensen* was not cited in prosecution. EX1002.

Similar to *Koniuk*, *Christensen* relates to a prosthetic ankle foot device including first and second prosthetic members. *See* EX1009 at Abstract. In one embodiment (Fig. 7, reproduced below), *Christensen* discloses that the device includes a "resilient and energy storing foot member [422]." *Id.* at [0064]. The foot member 422 curves "downwardly and forwardly to a toe section 444 at a toe location of toes of a natural foot, and [] downwardly and rearwardly to a heel section 438 at a heel location of a natural heel." *Id. Christensen* also describes an ankle member 418 pivotably attached to the foot member 422 and including an attachment section 426 for a lower leg prosthesis of an amputee. *See id.*

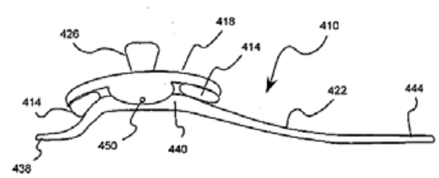


FIG. 7

Christensen describes the foot member 422 as "an elongated spring capable of storing energy during deflection," *id.* at [0011], that is "much like a leaf spring," *id.* at [0040]. *Christensen* further teaches that at least a toe portion 444 of the foot member 422 resiliently flexes towards the ankle member 418 and the attachment section 426 for the lower leg prosthesis as a load is applied onto the toe portion 444. *See id.* at [0053] ("as the user continues to step, or walk, on the foot device 10, the toe portion 44 of the second member 22 deflects . . . . [T]he second member 22 or toe portion 44 [] deflect[s] and/or move[s] with respect to the first member 18"); *see also id.* at [0064]; EX1003 at ¶¶167-168.

As discussed above in Section VII.1, *Koniuk* discloses that the attachment portion 34 includes a clamp 30 that attaches to a lower leg portion of a prosthetic limb having an axis. Modifying *Koniuk*'s foot blade 14 to include a resilient section of at least its front portion 14a, as disclosed by *Christensen*, allows the front portion 14a of the foot blade 14 to "deflect and/or move with respect to the" attachment portion 34 and the axis of the prosthetic limb. *See* EX1009 at [0053]; EX1003 at ¶173. The resilient front portion 14a of the foot blade 14 would be associated with the coupling point between the foot blade 14 and the attachment portion 34 and the coupling point between the attachment portion 34 and the prosthetic limb by deflecting relative to these points. *See* EX1009 at Fig. 7; EX1003 at ¶174.

And as discussed above in Section VII.1, *Koniuk* discloses that the damping means provides hydraulic damping to relative motion between the attachment portion 34 and the foot blade 14. The modified foot blade 14 of *Koniuk* being "an elongated spring capable of storing energy during deflection," EX1009 at [0011], as taught by *Christensen*, acts in series with the damping means, such that, as a "load is applied to the [] foot member . . . , the [] foot member defines a spring that deflects," *id.* at [0067], and a "damping level is achieved . . . to allow the weight of the wearer to be supported upon the foot blade 14," EX1010 at 7:59-62. *See also* EX1003 at ¶175.

i. ***Rationale* for Combining *Koniuk* and *Christensen***

Christensen teaches that the toe portion 444 of the foot member 422 deflects relative to the ankle member 418 to "provid[e] a soft, cushioned feel." EX1009 at [0053]. Hence, a POSA would have been motivated, with a reasonable expectation of success, to modify the foot blade 14 described in *Koniuk* to include a resilient section for at least its front portion 14a, as disclosed by *Christensen*, to provide a soft and cushioned feel for the user of *Koniuk*'s apparatus. *Id.*; *see also* EX1003 at ¶¶ 169-171. There would have been nothing unpredictable or unexpected in developing the claimed resilient foot component because the '312 patent recognizes that such a resilient foot component was conventional and well known to a POSA. EX1001 at 9:64-67 ("[t]he yielding action is provided by a hydraulic damper coupled to *conventional* foot elements (i.e. keel, carrier and independent carbon fibre composite heel-toe springs)") (emphasis added). *See also* EX1003 at ¶¶ 172.

The combination of *Koniuk* and *Christensen* teaches the element of claims 16-22, and therefore, these claims should be found unpatentable under § 103(a).

4. Ground 4: Claims 9-15 Are Rendered Obvious Under 35 U.S.C. § 103(a) by *Koniuk* in View of *Mortensen*

To the extent *Koniuk* does not explicitly disclose certain features recited in claims 9-15, *Mortensen* (EX1012) supplies these teachings. *Mortensen* was published on July 15, 1980, and is prior art to the '312 patent under § 102(b). *Mortensen* was not cited in prosecution. EX1002.

a. Claims 9-14

Mortensen teaches a bolt 14 acting as a pivot for two components of the prosthesis, the bolt 14 positioned in front of the hydraulic cylinder 16 and piston 41 relative to the user. *See* EX1012, Fig. 1; 4:30-39. *Koniuk* discloses a “hydraulic cylinder 50b that is positioned behind the attachment portion 34, closer to a heel portion of an attachable foot blade” with the attachment portion and the ankle pivot pin in front of that hydraulic cylinder. EX1010 at 6:52-54. Thus, the combined teachings of *Koniuk* and *Mortensen* teach an ankle pivot pin positioned to the anterior of the central axis of the hydraulic cylinder and piston assembly. EX1012, Fig. 1, 4:30-39; EX1010 at 6:52-54; *see also* EX1005 at ¶¶202-204.

Mortensen further discloses a single, linear hydraulic cylinder and piston for controlling flexion of a prosthesis. *See* EX1012 at Abstract (a “hydraulic knee control for a prosthetic leg has a cylinder and piston”); *id.* at 1:35-38. Fig. 2 of *Mortensen* (reproduced here) illustrates *Mortensen*’s hydraulic cylinder and piston. *Mortensen* describes that a hydraulic cylinder 16 and a piston 41 control the relative pivoting motion between two components of the prosthesis. *Id.* at 2:6-15 (“[T]he shank portion 13 and the thigh portion 12 pivot relative to each other about bolt 14 in a standard manner. This pivot or knee action is controlled by . . . a cylinder 16 . . . and [] a connective rod 18.”).

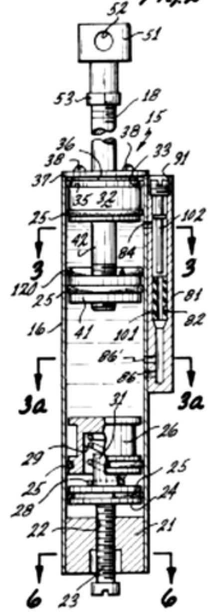
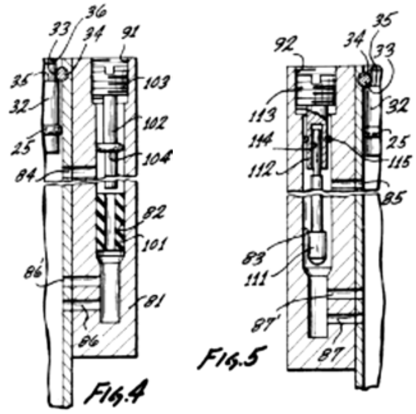


FIG. 2

Mortensen teaches two hydraulic passageways and a valve system for controlling the flow of hydraulic fluid between opposite regions in the hydraulic cylinder 16 caused by linear movement of the piston 41 within the cylinder 16. *Id.*



at Abstract ("[O]ne end of each passageway communicates with the cylinder in the region between the piston and crank end and the other end of each passageway communicates with the cylinder in the region between the piston and the floating plug. One of the passageways has a one-way adjustable valve . . . , and the other passageway has a one-way adjustable valve."); *see also id.* at 3:44-45. The two-valve system allows a user to control the resistance to relative flexing or pivoting between the two components of the prosthesis. *See id.* at 1:35-38 ("A primary object of this invention is . . . control for a leg prosthetic wherein the resistance of flexion is not the same as the resistance to extension.").

As illustrated in Figs. 4-5 of *Mortensen*, the one-way valves include adjustable heads 103, 113 that each individually control the hydraulic fluid flow between the opposite regions in the hydraulic cylinder 16 by screwing into and out of wells 82, 83 of the passageways, which in turn controls the resistance and the rate at which the two components of the prosthesis flex or pivot relative to each other in a first and a second direction. *See id.* at 3:11-13 ("[b]ypass well 82 controls the rate at which the leg extends itself and well 83 controls the rate at which the leg flexes"); *id.* at 3:44-66 ("When the knee flexes or bends, piston 41 moves down into the cylinder 16 while urging oil out . . . . To control the rate of flow, head 113 is screwed into or out of well 83. . . . When the leg tends to extend, the piston 41 moves towards the crank end, urging oil out . . . . To control this rate of oil flow, head 103 is screwed into or out of the well 82.”).

Mortensen further describes that one passageway includes a sleeve 101 that moves and urges against a pin 102 to block the flow of hydraulic fluid during flexion in the first direction, and that the other passageway includes a pin 111 that moves and urges against a shoulder to block the flow of hydraulic fluid during flexion in the second direction. *Id.* at 3:44-48, 3:56-62. Accordingly, the area between the sleeve 101 and the pin 102 reduces with flexion in the first direction, and the area between the pin 111 and the shoulder reduces with flexion in the second direction. *Id.*; *see also* EX1003 at ¶196.

i. ***Rationale for Combining* Koniuk *and* Mortensen**

Although *Koniuk*’s damping means disclosed in its Fig. 3 embodiment includes a plurality of hydraulic cylinders, *Koniuk* expressly teaches that, “[a]lternately, a *single hydraulic cylinder* may be employed.” EX1010 at 9:20-23 (emphasis added). *Koniuk* further teaches that the single hydraulic cylinder includes “a plurality of internal pressure chambers 58, further having required fluidic couplings, through which the flow rate of fluid can be set to at least two levels.” *Id.* at 9:23-26.

Like *Koniuk*, *Mortensen* discloses a single, linear hydraulic cylinder with a plurality of internal regions and fluid passageways to control the flow rate of fluid between the regions. Hence, it would have required no more than routine effort for one of ordinary skill in the art to incorporate the teachings of *Mortensen*'s single, linear hydraulic cylinder and piston with *Koniuk*'s suggestion to use a single cylinder-and-piston arrangement to arrive at a prosthetic ankle and foot apparatus including a damping means with a single, linear hydraulic cylinder and piston. EX1003 at ¶¶200-205. There would have been nothing unpredictable or unexpected regarding the development of a damping means with a single, linear hydraulic cylinder and piston because *Koniuk* explicitly suggests precisely such an arrangement. EX1010 at 9:20-23; EX1003 at ¶206.

As explained above, *Koniuk* and *Mortensen* both teach fluid passageways and a valve system to control hydraulic fluid flow between regions of a single hydraulic cylinder. *See* EX1010 at 6:60-67, 9:23-26; EX1012 at Abstract. Hence, it would have required no more than routine effort for one of ordinary skill in the art to also incorporate the teachings of *Mortensen*'s valve system with its single, linear hydraulic cylinder and piston assembly to *Koniuk*'s prosthetic ankle and foot apparatus 10. EX1003 at ¶205. There would have been nothing unpredictable or unexpected regarding the development of a damping means with a single, linear hydraulic cylinder and piston having a valve system for controlling resistance because *Koniuk* explicitly suggests this structure. EX1010 at 9:20-26; *see also id.* at 6:65-73:3 (suggesting "conventional damping control arrangements, including . . . controllable pet-cock arrangements and other flow control mechanisms available and known to skilled persons."); EX1003 at ¶206.

b. Claim 15

Mortensen also teaches a "resilient O-ring 120 disposed floating between piston 41 and sleeve 32 to absorb any force between the two members when they come in contact." EX1012 at 4:13–15. The sleeve is part of the crank end of the hydraulic cylinder. *See id.* at 2:31–32 ("[t]he crank end of the cylinder has a sleeve 32").

A POSA, reading *Mortensen*'s teachings that the O-ring 120 is resilient and absorbs force from mechanical contact, would have understood that the O-ring 120 is a cushioning structure that increases resistance to the piston's 41 movement towards the crank end of the hydraulic cylinder 16. *Id.*, Fig. 2, 4:13–15; EX1005 at ¶198. As the piston 41 moves toward the crank end of the hydraulic cylinder 16 and causes contact between the O-ring 120 and the sleeve 32, the O-ring 120 functions to increase resistance to the piston's 41 movement because it resiliently absorbs the force applied by the piston 41 on the sleeve 32. EX1012, Fig. 2, 4:13–15; EX1005 at ¶198. Hence, *Mortensen* discloses this claimed feature.

i. ***Rationale for Combining* Koniuk *and* Mortensen**

A POSA would have been motivated to incorporate the resilient O-ring 120 described in *Mortensen* into the *Koniuk* hydraulic cylinder and piston assembly, for absorbing contact forces between the pistons 56 and the hydraulic cylinders 50a, 50b. EX1012 at 4:13–15; EX1005 at ¶¶207-208. Under *Mortensen*'s teachings, a POSA would have recognized to dispose the resilient O-rings 120 on the top ends of the pistons 56 to resiliently absorb contact between the top ends of the pistons 56 and the top ends of the hydraulic cylinders 50a, 50b. *Id. Mortensen*'s resilient O-ring 120 incorporated with *Koniuk*'s hydraulic cylinder and piston assembly near the front portion 14a of the foot blade 14 would increase resistance to the pivoting or flexing of the attachment portion 34 as it reaches the pivot or flexion limit towards the front portion 14a, and would prevent trauma, wear, and sudden step-changes in gait. EX1005 at ¶208. And because both *Koniuk* and *Mortensen* teach hydraulic cylinder and piston assemblies with the piston abutting or contacting an end of the cylinder, *see* §§ VII.1. and VII.4.ii., *supra*, one of ordinary skill in the art would have a reasonable expectation of successfully incorporating the resilient O-ring 120 from *Mortensen*'s hydraulic cylinder and piston assembly to *Koniuk*'s hydraulic cylinder and piston assembly.

The combination of *Koniuk* and *Mortensen* teaches every element of claims 9-15, and so these claims should be found unpatentable under § 103(a).

Dependent Claim 9	**Citations in *Koniuk* & *Mortensen***
[9.1] A prosthetic foot and ankle assembly according to claim 1, wherein said joint mechanism comprises a hydraulic linear piston and cylinder assembly and a valve arrangement controlling the flow of hydraulic fluid between chambers of the piston and cylinder assembly on opposite sides of the piston thereof, the valve arrangement allowing individual setting of dorsi- and plantar-flexion damping resistances, and	*Koniuk* (EX1010) at 9:23-28 ("Alternately, a single hydraulic cylinder may be employed (not illustrated) having a plurality of internal pressure chambers 58, further having required fluidic couplings, through which the flow rate of fluid can be set to at least two levels, enabling the establishing of a first damping level and a second damping level.") *Id.* at 6:60-67 ("[A]ny arrangement that is structured to control a flow rate at which fluid may be transferred from a first internal chamber to a second internal chamber . . . may be employed to select a first damping level or a second damping level . . . [such as,] conventional damping control arrangements, including piezo-type values [sic], controllable pet-cock arrangements."). *Mortensen* (EX1012) at Abstract ("[A] hydraulic knee control for a prosthetic leg has a cylinder and piston . . . . Disposed outside of the cylinder are two bypass passageways wherein one end of each passageway communicates with the cylinder in the region between the piston and crank end and the other end of each passageway communicates with the cylinder in the region between the piston and the floating plug. One of the passageways has a one-way adjustable valve which allows the liquid to move only from the head end to the crank end in a controlled manner, and the other passageway has a one-way adjustable valve which allows the liquid to move only from the crank end to the head end in a controlled manner.") *Id.* at 1:35-38 ("[A] hydraulic knee control for a leg prosthetic wherein the resistance of flexion is not the same as the resistance to extension."); 2:6-15 ("[T]he shank portion 13 and the thigh portion 12 pivot relative to each other about bolt 14 in a standard manner. This pivot or knee action is controlled by . . . a cylinder 16 . . . and [] a connective rod 18."); 3:44-66 ("When the knee flexes or bends, piston 41 moves down into the cylinder 16 while

	urging oil out . . . . When the leg tends to extend, the piston 41 moves towards the crank end, urging oil out."); *see also* EX1003 at ¶191-196**.**
[9.2] wherein the joint mechanism defines a medial-lateral joint flexion axis, and the joint flexion axis is to the anterior of the said central axis of the piston and cylinder assembly.	*Koniuk* (EX1010) at 6:52-54 (A "hydraulic cylinder 50b [] positioned behind the attachment portion 34, closer to a heel portion of an attachable foot blade 14."). *Mortensen* (EX1012), Fig. 1; 4:30-39 ("A leg prosthetic comprising: an upper thigh member; a lower shank member; a knee joint pivotably connecting said members; and first means pivotably connected between said members for control of said knee joint and comprising: a cylinder . . . ; a piston slidably disposed within said cylinder."); *see also* EX1003 at ¶202-204.

Dependent Claim 10	
[10.1] A prosthetic foot and ankle assembly according to claim 9, wherein said joint mechanism includes two passages in communication with a variable-volume chamber of the piston and cylinder assembly, each passage containing a respective non-return valve, one oriented to prevent the flow of fluid from the chamber through its respective passage and the other oriented to prevent the admission of fluid to the chamber through the other passage.	*Mortensen* (EX1012) at Abstract ("[A] hydraulic knee control for a prosthetic leg has a cylinder and piston . . . . Disposed outside of the cylinder are two bypass passageways wherein one end of each passageway communicates with the cylinder in the region between the piston and crank end and the other end of each passageway communicates with the cylinder in the region between the piston and the floating plug. One of the passageways has a one-way adjustable valve which allows the liquid to move only from the head end to the crank end in a controlled manner, and the other passageway has a one-way adjustable valve which allows the liquid to move only from the crank end to the head end in a controlled manner.").

Dependent Claim 11	
[11.1] A prosthetic foot and ankle assembly according to claim 10, including an adjustable damping	*Mortensen* (EX1012) at 3:11-13 ("Bypass well 82 controls the rate at which the leg extends itself and well 83 controls the rate at which the leg flexes."); 3:44-66 ("When the knee flexes or bends, piston 41 moves down into the cylinder 16 while urging oil out . . . . To control

orifice in at least one of the two passages.	the rate of flow, head 113 is screwed into or out of well 83. . . . When the leg tends to extend, the piston 41 moves towards the crank end, urging oil out . . . . To control this rate of oil flow, head 103 is screwed into or out of the well 82.”).

Dependent Claim 12	
[12.1] A prosthetic foot and ankle assembly according to claim 10, including an adjustable damping orifice that forms part of a passage in communication with the chamber and through which fluid flows during flexion of the ankle joint in a dorsi direction.	*See* Limitation [11.1], *supra*.

Dependent Claim 13	
[13.1] A prosthetic foot and ankle assembly according to claim 12, wherein said joint mechanism includes a flexion limiter limiting dorsi-flexion of the joint mechanism to a dorsi-flexion limit, and	*See* § VII.1 (tables) at Limitations [3.2] and [4.1], *supra*.
[13.2] wherein the adjustable damping orifice has a dorsi-flexion orifice area that is variable according to joint flexion, the area reducing as dorsi-flexion of the joint mechanism approaches the dorsi-flexion limit.	*Mortensen* (EX1012) at 3:44-48 (“When the knee flexes or bends, piston 41 moves down into the cylinder 16 while urging oil out of apertures 86, 86', 87, and 87'. . . . [A]s the oil tends to flow into apertures 86 and 86', sleeve 101 is urged against pin 102, blocking any flow of oil.”); 3:56-62 (“When the leg tends to extend, the piston 41 moves towards the crank end, urging oil out of the apertures 84 and 85. . . . [W]hen oil is moving from cylinder 16 into the well 83 through aperture 85, pin 111 is urged against the shoulder formed by the reduced portion therein, thereby blocking oil flow.”); *see also* EX1003 at ¶195-197.

Dependent Claim 14	
[14.1] A prosthetic foot and ankle assembly according to claim 12, including a second adjustable damping orifice through which fluid flows during flexion of the joint mechanism in a plantar direction.	*See* Limitation [11.1] above.

Dependent Claim 15	
[15.1] A prosthetic foot and ankle assembly according to claim 1, wherein said joint mechanism includes a flexion limiter limiting dorsi-flexion of the joint mechanism to a dorsi-flexion limit, the assembly including a cushioning device for increasing resistance to dorsi-flexion as flexion of the ankle joint approaches said dorsi-flexion limit.	*Mortensen* (EX1012) at 2:31-32 ("The crank end of the cylinder has a sleeve 32."); 4:13-15 (A "resilient O-ring 120 disposed floating between piston 41 and sleeve 32 to absorb any force between the two members when they come in contact."); *see also* EX1003 at ¶197.

5. Ground 5: Claims 1-8 and 16-22 Are Anticipated Under 35 U.S.C. § 102(b) by *Townsend*

Townsend (EX1011) was published on June 17, 2004, and is prior art to the '312 patent under § 102(b). During prosecution, the Examiner relied on *Townsend* as a secondary reference to teach "a medial-lateral joint flexion axis that is anterior to the central axis of the shin axis . . . to approximate the natural orientation of medial-lateral flexion of a natural human foot, to closely mimic a natural subtalar joint and result in more comfortable ambulation for the user." EX1002 at 1271. Applicants never contested that finding.

Townsend relates to a prosthetic foot/ankle incorporating a foot keel 77 and shank 72 and a two-way adjustable hydraulic device 71 connected to it that "limits the extent of the motion" the prosthesis undergoes during gait. EX1011 at Abstract. The prosthetic includes a joint mechanism 71 that is a two-valve two-chamber adjustable cylindrical hydraulic piston, *see id.* at Figs. 28-32; EX1003 at ¶71. *Townsend* teaches:

> [t]he device has two variable controls, one for compression [plantar flexion], one for expansion [dorsi flexion], which permit adjustment of the permissible extent of the motion of the upper end of the calf shank in both compression and expansion of the calf shank in force loading and unloading. The device **71** also dampens the energy being stored or released during calf shank compression and expansion.

EX1011 at [0095]. Device 71 leads to "improved dynamic response capabilities," *id.* at 15:10-13, and "the ability to 'tune'" the device creates "high gait efficiency and comfort." *Id.* 15:15-60; EX1003 at ¶71.

Townsend, at paragraphs [0094]-[0101], describes various ways in which the hydraulic unit substantially dampens "the compression (plantar flexion) and expansion dorsiflexion" using "valves" which, "when nearly closed," force the unit's damping force "very high, making rapid walking and even running possible." EX1011 at [0098]. It also discloses conventional "fasteners" such as "two releasable fasteners" to connect the foot keel with the device. *Id.* at [0099].

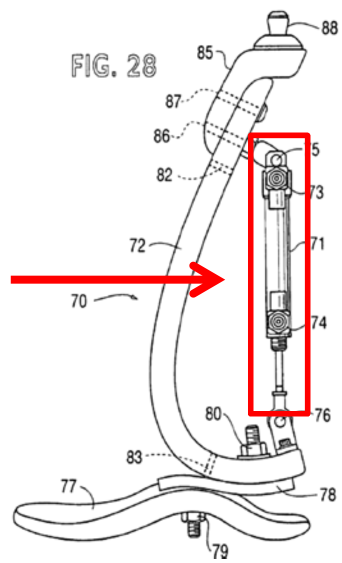


FIG. 28

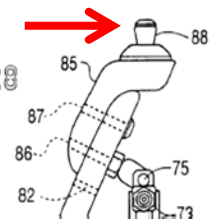
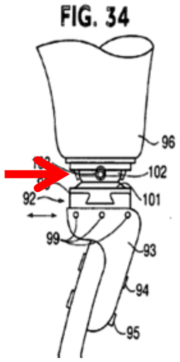
Townsend further teaches that the "prosthetic foot of the invention is a modular system preferably constructed with standardized units or dimensions for flexibility and variety in use." *Id.* at [0073]; *see* EX1003 at ¶72.

Townsend includes conventional pyramid-alignment interfaces for connecting the device to a user's shin or other types of conventional connections, 88 ("inverted pyramid-shaped attachment fitting), 92 ("alignment coupler device"), and for angling the calf shank to a desired adjustment angle. *See* EX1011 at Abstract, [0100] ("pyramid"), [0105] ("The top of the upper slide 98 of the device 92 has an inverted pyramid shaped fitting 101 . . . . This connection between . . . allows for angular change flexion/ extension and abduction/ adduction between the prosthetic socket and foot."). Thus, Townsend teaches a hydraulic ankle mechanism that uses a hydraulic linear piston assembly 71 with two chambers and variable valves that is meant to dampen ankle flexion in the dorsi- and plantar-flexion direction using predominantly hydraulic forces during walking. *See* EX1011 at [0094]-[0101]; *see also* EX1003 at ¶¶59-61. For these and the reasons below, *Townsend* anticipates claims 1-8 and 16-22 of the '312 patent.

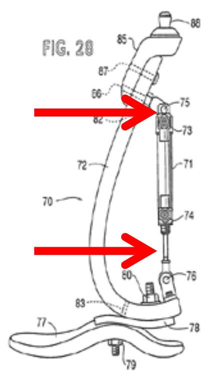
Independent Claim 1	**Citations in *Townsend***
[1.0] A prosthetic foot and ankle assembly comprising the combination of:	*Townsend* (EX1011) at [0005] ("The prosthetic foot of the present invention."); [0009] ("a foot keel and calf shank of a prosthetic foot").
[1.1] a foot component; and	EX1011 (*Townsend*) at [0096] ("foot keel 77"); [0075] ("foot keels 2, 33, 38, 42, and 43.").
[1.2] an ankle joint mounted to the foot component, the ankle joint comprising:	EX1011 (*Townsend*) at 70; *id.* at cl. 1 ("ankle joint area"); *id.* at cl. 24 ("ankle coupler").
[1.3] a joint mechanism providing	EX1011 (*Townsend*) at [0007] ("The prosthetic foot can also include a device to limit the extent of the motion of

resistance to ankle flexion,	the upper end of the calf shank in response to force loading and unloading the calf shank during use of the prosthetic foot. In one embodiment, the device is a piston-cylinder unit connected between the upper and lower ends of the calf shank and containing at least one pressurized fluid to limit the extent of motion and also dampen the energy being stored or released during calf shank compression and expansion.”). *Id.* at [0095] (“The device 71 in the example embodiment is a two-way acting piston cylinder unit in which pressurized fluids, a gas such as air or a hydraulic liquid, are provided through respective fittings 73 and 74. The device has two variable controls, one for compression, one for expansion, which permit adjustment of the permissible extent of the motion of the upper end of the calf shank in both compression and expansion of the calf shank in force loading and unloading.”).
[1.4] wherein the joint mechanism is constructed and arranged such that during walking said resistance is predominantly provided by hydraulic damping whenever the ankle joint is flexed in both dorsi- and plantar-flexion directions.	EX1011 (*Townsend*) at [0095] (“The device 71 . . . has two variable controls, one for compression, one for expansion, which permit adjustment of the permissible extent of the motion of the upper end of the calf shank in both compression and expansion of the calf shank in force loading and unloading. The device 71 also dampens the energy being stored or released during calf 65 shank compression and expansion.”). *Id.* at [0098] (“When the valves are nearly closed, the unit dampening force becomes very high, making rapid walking and even running possible. The unique prosthesis-adjustable dynamic factor allows the hydraulic unit to be optimized for all gait patterns from slow to aggressive, fast gait speeds and movements.”); *see also* EX1005 at ¶54, 68-61.

Dependent Claim 2	

[2.1] A prosthetic foot and ankle assembly according to claim 1, further comprising a shin connection interface, wherein said joint mechanism includes a flexion limiter limiting dorsiflexion of the joint mechanism to a dorsi-flexion limit, and	EX1011 (*Townsend*) at EX1011 at Fig. 28 (items 85-55) and Fig. 34 (items 101-103). *Townsend* discloses the claimed "flexion limiter": EX1011 at [0007] ("The prosthetic foot can also include a device to limit the extent of the motion of the upper end of the calf shank in response to force loading and unloading the calf shank during use of the prosthetic foot."). *Id.* at [0094] ("The prosthetic foot 70 shown in FIGS. 28-32 is similar to those in FIGS. 3-5, 8, 23, and 24 and FIGS. 25-27, but further includes a calf shank range of motion limiter"); [0101] ("the motion limiting, dampening device 71.").
[2.2] wherein the shin connection interface is arranged to allow connection of a shin component at different anterior-posterior tilt angles, including angles resulting in the shin component having an anterior tilt of at least 3 degrees with respect to the vertical when the joint mechanism is flexed to the dorsiflexion limit.	EX1011 (*Townsend*) at [0100] ("A prosthetic socket attached to the amputee's lower leg stump is connected to the upper end of calf shank 72 via an adapter 85 secured to the upper end of the calf shank by fasteners 86 and 87 as shown in the drawings. The adapter has an inverted pyramid-shaped attachment fitting 88 connected to an attachment plate attached to an upper surface of the adapter."). FIG. 28  *Id.* at Abstract ("The upper end of the calf shank can include an alignment coupler device (92) . . . to adjust the medial/lateral and anterior/posterior position of the calf shank relative to a supporting structure on the leg of the person using the prosthetic foot."). FIG. 34  *Id.* at [0105] ("The top of the upper slide 98 of the device 92 has an inverted pyramid shaped fitting 101 secured thereon which is adjustably clamped in a corresponding fitting 102 on the prosthetic socket 96

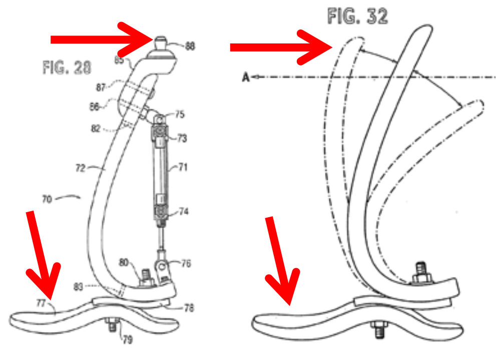
	by means of threaded fasteners 103. This connection between fitting 101 and 102 allows for angular change flexion/ extension and abduction/ adduction between the prosthetic socket and foot.”).

Dependent Claim 3	
[3.1] A prosthetic foot and ankle assembly according to claim 1, further comprising a shin connection interface,	*See* Limitations [1.0-1.4] and [2.1], *supra*.
[3.2] wherein the joint mechanism includes a flexion limiter limiting dorsi-flexion of the joint mechanism to a dorsi-flexion limit, and	*See* Limitation [2.1], *supra*.
[3.3] wherein the assembly is arranged such that the dorsi-flexion limit corresponds to a predetermined relative orientation of the shin component interface relative to the foot component.	FIG. 28  EX1011 (*Townsend*) at cl. 1 (“a device extending between and connected to the upper and lower ends of the shank to dampen the motion and limit the extent of the upper end of the shank in at least one of compression and expansion.” Figure 28, 29, and 30 show physical mechanical abutments of the hydraulic cylinder.”).

Dependent Claim 4	
[4.1] A prosthetic foot and ankle assembly according to claim 3, wherein the dorsi-flexion limit is defined by a mechanical end-stop operative by the abutment of one part of the assembly associated with the shin component interface against another part of the assembly associated with the foot component.	EX1011 (*Townsend*) at Fig. 38, element 71 (Plunger hits bottom of cylinder 71).

Dependent Claim 5	
[5.1] A prosthetic foot and ankle assembly according to claim 4, wherein the joint mechanism comprises a hydraulic linear piston and cylinder assembly, wherein the piston has a distal connection and the cylinder has a	EX1011 (*Townsend*) at Fig. 38, element 71 (Plunger hits bottom of cylinder 71 end wall).

proximal connection, and wherein the end stop is defined by the piston and an end wall of the cylinder.	

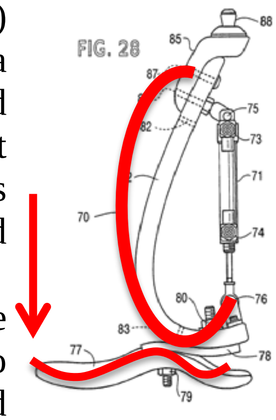
Dependent Claim 6	
[6.1] A prosthetic foot and ankle assembly according to claim 1, further comprising a shin connection interface,	*See* Limitations [1.1-1.4] and [2.1] above.
[6.2] wherein said joint mechanism includes a flexion limiter limiting dorsi-flexion of the joint mechanism to a dorsi-flexion limit, and	*See* Limitations [2.1] above.
[6.3] wherein the assembly is arranged such that the relative position of the foot component and the shin connection interface at the dorsi-flexion limit is defined independently of the orientation of the assembly in space.	*Townsend* (EX1011) at Fig. 28, 32. 

Dependent Claim 7	
[7.0] A prosthetic foot and ankle assembly according to claim 1, arranged such that the resistance to flexion of said joint mechanism in a direction of dorsi-flexion is adjustable.	EX1011 (*Townsend*) at [0095] ("The device has two variable controls, 60 one for compression, one for expansion, which permit adjustment of the permissible extent of the motion of the upper end of the calf shank in both compassion and expansion of the calf shank in force loading and unloading. The device 71 also dampens the energy being stored or released during calf 65 shank compression and expansion.").

Dependent Claim 8	
[8.1] A prosthetic foot and ankle assembly according to claim 1**,** having at least one pyramid alignment interface allowing adjustment of shin axis orientation in an anterior-posterior direction with respect to the foot component.	*See* Limitations [1.0]-[1.4] & [2.2], *supra*.

Independent Claim 16	
[16.0] A lower limb prosthesis comprising:	*See* Limitation [1.0], *supra*.
[16.1] shin component defining a shin axis,	*See* Limitations [1.0]-[1.2], *supra*; *see also* EX1011 (*Townsend*) at Fig. 28, element 72 (shin component defining a shin axis).
[16.2]a foot component, and	*See* Limitation [1.1], *supra*.
[16.3] a prosthetic ankle joint comprising a mechanism providing resistance to ankle flexion,	*See* Limitations [1.2] & [1.3], *supra*.
[16.4] wherein the mechanism is constructed and arranged such that said resistance is predominantly provided by hydraulic damping whenever the ankle joint is flexed in both dorsi- and plantar flexion directions,	*See* Limitations [1.4], *supra*.
[16.5] said ankle joint coupling the shin component to the foot component,	EX1011 (*Townsend*) at [0092] ("releasable fasteners 79 and 80 spaced longitudinally connecting the coupling element to the calf shank and foot keel.").
[16.6] wherein at least one of the foot component and the shin component includes a resilient section allowing resilient dorsi-flexion of at least an anterior portion of the foot component relative to the shin axis.	EX1011 (*Townsend*) at cl. 1, 26, 44, 46 ("a resilient, upstanding, monolithically formed shank," "resilient member). *Id.* at [0059] ("The forefoot, midfoot and hindfoot portions of the foot keel 2 are formed of a single piece of resilient material"); [0060] ("The resilient material's physical properties as they relate to stiffness, flexibility and strength are all determined by the thickness of the material.").

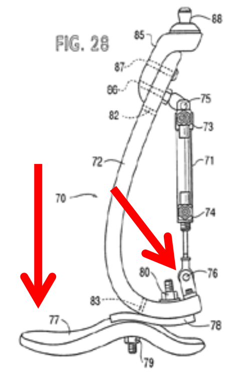
Dependent Claim 17	
[17.1] A prosthesis according to claim 16, wherein the foot component comprises an energy-storing spring arranged to be deflected when a dorsi-flexion load is applied to the foot anterior portion.	EX1011 (*Townsend*) at [0096] ("foot keel 77" 15:8; "foot keels 2, 33, 38, 42, and 43.").

Dependent Claim 18	
[18.1] A prosthesis according to claim 16, wherein the resilient section is associated with the coupling of the foot component and the ankle joint.	EX1011 (*Townsend*) at [0099] (discloses a foot, shin (calf), and ankle joint that join at "releasable fasteners 79 and 80 spaced longitudinally connecting the coupling element to the calf shank and foot keel."). FIG. 28 

Dependent Claim 19	
[19.1] A prosthesis according to claim 16, wherein the resilient section is associated with the coupling of the shin component to the ankle joint.	EX1011 (*Townsend*) at [0099] (resilient section "foot keel" joins at "releasable fasteners 79 and 80 spaced longitudinally connecting the coupling element to the calf shank and foot keel.").

Independent Claim 20	
[20.1] A prosthetic foot/ankle assembly comprising the combination of	*See* Limitations [1.0] and [1.1], *supra* .
[20.2] (a) a prosthetic ankle joint comprising a mechanism providing resistance to ankle flexion,	*See* Limitation [1.3], *supra*.
[20.2] wherein the mechanism is constructed and arranged such that said resistance is predominantly provided by hydraulic damping whenever the ankle joint is flexed in both dorsi- and plantar-flexion directions, and	*See* Limitation [1.4], *supra*.
[20.3] (b) a prosthetic foot having an anterior portion, a posterior portion and an ankle-mounting portion,	*Townsend* discloses interchangeable modular foot keels. *See* Limitations [1.1] [16.6], & [17.1], *supra*.
[20.4] wherein the assembly constitutes a Maxwell-model damper/spring combination comprising a damper element and a spring element, wherein the damper element is said ankle joint and the spring element is a spring	*See* Limitation [16.6], *supra* (resilient foot keel); EX1011 (*Townsend*) at Fig. 28 (keel acting in series with hydraulic ankle); *see also* EX1005 at

component arranged in series with the ankle joint.	¶78.

Dependent Claim 21		
[21.1] An assembly according to claim 20, wherein the spring component is located distally of said ankle joint.	*See Townsend* (EX1012) at Fig. 28 (showing spring component distal of ankle joint); *see also* EX1005 at ¶79.	

Dependent Claim 22	
22. An assembly according to claim 20, wherein the spring component is a leaf spring supporting the anterior portion of the foot on the ankle-mounting portion thereof.	EX1011 (*Townsend*) at 77; *see also id.* at [0091]; Limitations [1.1], [16.6], & [17.1], *supra* (providing spring force); EX1005 at ¶80.

6. Ground 6: Claims 9-15 Are Rendered Obvious Under 35 U.S.C. § 103(a) by *Townsend* in View of *Mortensen*

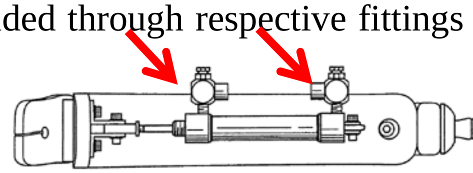
To the extent *Townsend* does not explicitly disclose certain limitations of claims 9-15; *Mortensen* supplies these teachings, thereby rendering claims 9-15 obvious under § 103(a).

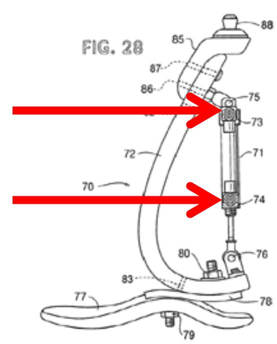
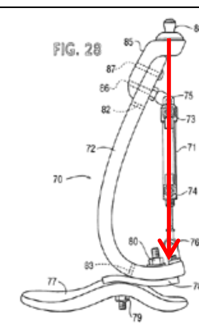
a. Claims 9-14

Mortensen teaches a single hydraulic cylinder and piston for controlling flexion and extension between two components of a prosthetic including two hydraulic passageways and an adjustable valve system for controlling the flow of hydraulic fluid between opposite regions in the hydraulic cylinder. *See supra* § VII.1., *supra*. And like *Koniuk*, *Townsend* discloses a mechanism of two hydraulic chambers in a single cylindrical piston that provides resistance to the ankle member pivoting or flexing relative to the heel or toe portion of the foot member. *See* EX1012 (*Townsend*) at [0095]; EX1005 at ¶235.

A POSA would have been motivated to incorporate the features of *Mortensen*'s linear hydraulic valve system to the linear hydraulic mechanism of *Townsend* for adapting the prosthesis to a variety of users and applications, as taught by *Townsend*. EX1012, at [0088] ("The human foot is a multi-functional unit—it walks, runs and jumps" and "the possibility exists to improve amputee athletic performance"); EX1005 at ¶¶232-239. For example, a POSA would have been motivated to incorporate the *Mortensen* valve system to the *Townsend* hydraulic mechanism to adapt the *Townsend* prosthesis for users of varying weight by adjusting the resistance to ankle flexion, depending on the user's weight, and for "adaption" of ankle flexion resistance based on the user's activities. *See, e.g.*, EX1016 (Murphy, 1964) at 34 (suggesting "providing separate bypass tubes or passages and independently adjustable valves for controlling flexion and extension" in leg prosthetics); EX1005 at ¶¶238-239. There would have been nothing unpredictable or unexpected in incorporating the *Mortensen* valve system into the *Gramnas* hydraulic mechanism as both *Gramnas* and *Mortensen* teach a known system of a single hydraulic cylinder and piston for hydraulically damping the flexion of two components of a prosthesis. *See* § VII.4; EX1005 at ¶¶210-221.

For at least the same reasons and the same reasons as § VII.4, *supra*, one of ordinary skill in the art would have been motivated, with a reasonable expectation of success, to modify *Townsend's* single hydraulic cylinder and piston with two hydraulic passageways and an adjustable valve system hydraulic cylinder for controlling the flow of hydraulic fluid between opposite regions in the hydraulic cylinder, as taught by *Mortensen*. EX1005 at ¶239.

Dependent Claim 9	**Citations in *Townsend* & *Mortensen***
[9.1] A prosthetic foot and ankle assembly according to claim 1, wherein said joint mechanism comprises a hydraulic linear piston and cylinder assembly and a valve arrangement controlling the flow of hydraulic fluid between chambers of the piston and cylinder assembly on opposite sides of the piston thereof,	*Townsend* (EX1011) at [0095] ("The device 71 in the example embodiment is a two-way acting piston cylinder unit in which pressurized fluids, a gas such as air or a hydraulic liquid, are provided through respective fittings 73 and 74.").  FIG. 30 *Mortensen* (EX1012) at Abstract ("[A] hydraulic knee control for a prosthetic leg has a cylinder and piston assembly. In addition, within the cylinder is disposed a free floating plug so that the space between the free plug and the head end is filled with air or a compressible fluid, and the spaces between the free plug and the crank end is filled with a liquid or hydraulic fluid. The piston is disposed within this liquid and has sealing means which prevents the liquid from bypassing therearound. Disposed outside of the cylinder are two bypass passageways wherein one end of each passageway communicates with the cylinder in the region between the piston and crank end and the other end of each passageway communicates with the cylinder in the region between the piston and the floating plug."). *Id.* at 1:35-38 ("A primary object of this invention is to provide a hydraulic knee control for a leg prosthetic wherein the resistance of flexion is not the same as the resistance to extension.").

	Id. at 3:44-59 ("When the knee flexes or bends, piston 41 moves down into the cylinder 16 while urging oil out of apertures 86, 86', 87, and 87'. . . . When the leg tends to extend, the piston 41 moves towards the crank end, urging oil out of the apertures 84 and 85."). *Id.* at Abstract ("Disposed outside of the cylinder are two bypass passageways wherein one end of each passageway communicates with the cylinder in the region between the piston and crank end and the other end of each passageway communicates with the cylinder in the region between the piston and the floating plug. One of the passageways has a one-way adjustable valve which allows the liquid to move only from the head end to the crank end in a controlled manner, and the other passageway has a one-way adjustable valve which allows the liquid to move only from the crank end to the head end in a controlled manner."); EX1005 at ¶¶, 195, 232, 239.
[9.2] the valve arrangement allowing individual setting of dorsi- and plantar-flexion damping resistances, and	*Townsend* (EX1011), at [0095] ("The device has two variable controls, 60 one for compression, one for expansion, which permit adjustment of the permissible extent of the motion of the upper end of the calf shank in both compression and expansion of the calf shank in force loading and unloading. The device 71 also dampens the energy being stored or released during calf 65 shank compression and expansion.") 
[9.3] wherein the joint mechanism defines a medial-lateral joint flexion axis, and the joint flexion axis is to the anterior of the said central axis of the piston and cylinder assembly.	*Townsend* (EX1011), at [0094] ("The motion of the upper end of the calf shank 72 of the foot 70 in compression and expansion of the calf shank is depicted in FIG. 32. The generally parabola shape of the calf shank is such that the upper end of the calf shank can move longitudinally with respect to the foot keel 77 and lower end of the calf shank connected thereto, e.g., along direction A-A in FIGS. 5 and 32, with compression and expansion of the calf 10 shank in force loading and unloading thereof."). 

Dependent Claim 10	
[10.1] A prosthetic foot and ankle assembly according to claim 9, wherein said joint mechanism includes two passages in communication with a variable-volume chamber of the piston and cylinder assembly, each passage containing a respective non-return valve, one oriented to prevent the flow of fluid from the chamber through its respective passage and the other oriented to prevent the admission of fluid to the chamber through the other passage.	*Mortensen*, (EX1012) at Abstract. "Disposed outside of the cylinder are two bypass passageways wherein one end of each passageway communicates with the cylinder in the region between the piston and crank end and the other end of each passageway communicates with the cylinder in the region between the piston and the floating plug. One of the passageways has a one-way adjustable valve which allows the liquid to move only from the head end to the crank end in a controlled manner, and the other passageway has a one-way adjustable valve which allows the liquid to move only from the crank end to the head end in a controlled manner."

Dependent Claim 11	
[11.1] A prosthetic foot and ankle assembly according to claim 10, including an adjustable damping orifice in at least one of the two passages.	*Townsend* (EX1011) at [0097] (The "resistance for compression is adjusted independent of the expansion adjustments," and "allows it to close the compression" and "when the valves are nearly closed."). *Mortensen* (EX1012) at 3:46-56 ("[A]s the oil tends to flow into apertures 86 and 86', sleeve 101 is urged against pin 102, blocking any flow of oil. The oil can flow only through bypass well 83 and out of aperture 85 into the other side of piston 41. To control the rate of flow, head 113 is screwed into or out of well 83. Whenever the head 113 is screwed into the well, the rate decreases because the lower or larger end of pin 111 is moved closer to the reduced diameter portion of the well. When the head 113 is screwed out of the well, then obviously the rate of flow increases."). *Id.* at 3:59-4:2 ("[W]hen oil is moving from cylinder 16 into the well 83 through aperture 85, pin 111 is urged against the shoulder formed by the reduced portion therein, thereby blocking oil flow therethrough. However,

	oil flows from cylinder 16 into well 82 through aperture 84 because the sleeve 101 is urged away from pin 102. To control this rate of oil flow, head 103 is screwed into or out of the well 82. Again, when the head 103 is screwed into the well, the rate of flow decreases because the inner end of pin 102 is moved closer to sleeve 101. When the head 103 is screwed out of the well, then obviously the rate of flow increases.”); .”); EX1005 at ¶¶ 195–197.

Dependent Claim 12	
[12.1] A prosthetic foot and ankle assembly according to claim 10, including an adjustable damping orifice that forms part of a passage in communication with the chamber and through which fluid flows during flexion of the ankle joint in a dorsi direction.	*Mortensen* (EX1012) at 3:11-13 (“[Bypass well 82 controls the rate at which the leg extends itself and well 83 controls the rate at which the leg flexes.”). *Id.* at 3:50-52 (“To control the rate of flow, head 113 is screwed into or out of well 83.”); 3:63-66 (“However, oil flows from cylinder 16 into well 82 through aperture 84 because the sleeve 101 is urged away from pin 102. To control this rate of oil flow, head 103 is screwed into or out of the well 82.”).

Dependent Claim 13	
[13.1] A prosthetic foot and ankle assembly according to claim 12, wherein said joint mechanism includes a flexion limiter limiting dorsi-flexion of the joint mechanism to a dorsi-flexion limit, and	*See* § VII.5 (charts) at Limitations [1.0-2.1]. [3.2] & [12.1], *supra*.
[13.2] wherein the adjustable damping orifice has a dorsi-flexion orifice area that is variable according to joint flexion, the area reducing as dorsi-flexion of the joint mechanism approaches the dorsi-flexion limit.	*Mortensen* (EX1012), at 15:30-50 (“The “resistance for compression is adjusted independent of the expansion adjustments,” and “allows it to close the compression” and “when the valves are nearly closed.”). *Id.* at 3:44-55 (“When the knee flexes or bends, piston 41 moves down into the cylinder 16 while urging oil out of apertures 86, 86', 87, and 87'. Referring to FIG. 4, as the oil tends to flow into apertures 86 and 86', sleeve 101 is urged against

	pin 102, blocking any flow of oil. The oil can flow only through bypass well 83 and out of aperture 85 into the other side of piston 41. To control the rate of flow, head 113 is screwed into or out of well 83. Whenever the head 113 is screwed into the well, the rate decreases because the lower or larger end of pin 111 is moved closer to the reduced diameter portion of the well.”).

Dependent Claim 14	
[14.1] A prosthetic foot and ankle assembly according to claim 12, including a second adjustable damping orifice through which fluid flows during flexion of the joint mechanism in a plantar direction.	*See* Limitations [11.1] & [12.1], *supra*.

b. Claim 15

Mortensen teaches a “resilient O-ring 120 disposed floating between piston 41 and sleeve 32 to absorb any force between the two members when they come in contact.” EX1012 at 4:13-15. The sleeve is part of the crank end of the hydraulic cylinder. *See id.* at 2:31-32 (“[t]he crank end of the cylinder has a sleeve 32”). As also explained above, a POSA reading *Mortensen*’s teachings that the O-ring 120 is resilient and absorbs force from mechanical contact would have understood that the O-ring 120 is a cushioning structure that increases resistance to the piston’s 41 movement towards the crank end of the hydraulic cylinder 16. *See* §VII.4, *supra*; EX1005 at ¶198. Hence, *Mortensen* discloses this claimed feature.

A POSA would have been motivated, with a reasonable expectation of success, to incorporate the resilient O-ring 120 described in *Mortensen* to the *Townsend* linear hydraulic cylinder and piston assembly 71, for absorbing contact forces between the piston and end of the hydraulic cylinder 71. EX1005 at ¶¶240-241. Under *Mortensen*'s teachings, a POSA would have recognized to dispose the resilient O-ring 120 on the face of *Townsend*'s piston to resiliently absorb contact between the piston and the end walls of the hydraulic chamber in 71. EX1005 at ¶¶240-241. *Mortensen*'s resilient O-ring 120 incorporated with *Townsend's* hydraulic assembly 71 would increase resistance to the pivoting or flexing of the ankle member as it reaches the pivot or flexion limit, and would prevent trauma, wear, and sudden step-changes in gait. EX1005 at ¶¶240-241.

C. CONCLUSION

Freedom respectfully requests *inter partes* review of claims 1-22 of U.S. Patent No. 8,574,312.

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CERTIFICATE OF SERVICE

I certify that on Monday, February 02, 2015, this Petition for *Inter Partes* Review of U.S. Patent No. 8,574,312 and Exhibits 1001-1030 were served via EXPRESS MAIL® on the following counsel of record for patent owner.

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